

COMBINED ARMS WARFARE IN THE 21ST CENTURY: MAXIMIZING THE
CAPABILITY OF U.S. ARMY FUTURE COMBAT SYSTEM EQUIPPED BRIGADE
COMBAT TEAMS TO CONDUCT COMBINED ARMS OPERATIONS

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MASTER OF MILITARY ART AND SCIENCE
Military History

by

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ABSTRACT

COMBINED ARMS WARFARE IN THE 21ST CENTURY: MAXIMIZING THE CAPABILITY OF U.S. ARMY FUTURE COMBAT SYSTEM EQUIPPED BRIGADE COMBAT TEAMS TO CONDUCT COMBINED ARMS OPERATIONS, by Major James W. Reed, USA, 178 pages.

The U.S. Army's first Future Combat System (FCS) equipped Brigade Combat Team (BCT) becomes fully operational in 2015. Concern for the possibility of combined arms capability gaps between planned FCS capacities and those required to defeat the expected 2015 dominant threat model – the Extremist Guerrilla Army – led to a study of combined arms operations. This thesis identifies 13 combined arms “enabling capabilities” necessary for FCS BCT success in the complex and lethal 2015 operational environment. These capabilities will defeat the Extremist Guerrilla Army, maintain freedom of movement across the battlefield, and positively influence the local populace to support U.S. objectives.

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Of course, the victory of achievement – in this case the achievement of finishing this master's thesis – is always tied to sacrifice. Although my family neither assisted in the research for this thesis, nor understood its tremendous potential for shaping the future of the U.S. Army, their sacrifices are forever linked to its completion. To my wife Erin, I could not have completed this project without your constant encouragement. In addition, your efforts in taking care of Riley, Dixie, Belle, and Darby by yourself are a testament to your dedication as the true leader of our pack.

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ACRONYMS

ACR	Armored Cavalry Regiment
ASR	Alternate Supply Route
BCT	Brigade Combat Team
CAS	Close Air Support
CAW	Combined Arms Warfare
CBRNE	Chemical, Biological, Radiological, Nuclear, and Explosive Incidents
COA	Course of Action
COE	Contemporary Operational Environment
COIN	Counterinsurgency
CSS	Combat Service Support
CTC	Combat Training Center
DGDP	Directorate of Graduate Degree Programs
EFP	Explosively Formed Penetrator
FCS	Future Combat Systems
FM	Field Manual
FM Radio	Frequency Modulation Radio
FOB	Forward Operating Base
GDP	Graduate Degree Programs
GPS	Global Positioning System
GWOT	Global War on Terrorism
HBCT	Heavy Brigade Combat Team
IED	Improvised Explosive Device
IO	Information Operations

IOC	Initial Operational Capability
JTAC	Joint Tactical Air Controllers
LOC	Line Of Communication
MCO	Major Combat Operations
MRAP	Mine-Resistant Ambush Protected Vehicle
MSR	Main Supply Route
NTC	National Training Center
OE	Operational Environment
PSYOP	Psychological Operations
ROVER	Remotely Operated Video Enhanced Receiver
RPG	Rocket Propelled Grenade
SBCT	Stryker Brigade Combat Team
SGA	Small Group Advisor
TACSAT	Tactical Satellite Communications
TRADOC	U.S. Army Training and Doctrine Command
UAS	Unmanned Aerial System
VBIED	Vehicle Borne Improvised Explosive Device

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CHAPTER 1

INTRODUCTION

It is not so much the mode of formation as the proper combined use of the different arms which will ensure victory.

Antoine Henri, Baron de Jomini: *Precis de l'Art de la Guerre*, 1838¹

The purpose of this thesis is twofold: first, to identify “combined arms enabling capabilities”; and second, to make recommendations to the Army’s Future Combat System (FCS) program office on technological, structural, or doctrinal changes needed to overcome combined arms capability gaps in FCS equipped Brigade Combat Teams (BCTs). The author’s qualifications for writing this topic include both professional military education and participation in the 2003-2004 ground invasion of Iraq (Operation Iraqi Freedom I), which was the U.S. Army’s most recent large-scale (Corps level) combined arms operation. While the focus of this thesis is specific to the issues facing FCS equipped BCTs, its findings will also be of benefit to personnel involved in Army force design. In addition, findings will contribute to the overall understanding and theory of combined arms warfare (CAW) as well.

This study consists of seven chapters. Chapter 1 serves as the document’s introduction. In this chapter the author identifies the primary problem to be solved as whether or not FCS equipped BCTs will possess significant combined arms capability gaps when the first FCS BCT becomes operational in 2015. Several assumptions are made; first among them is that combined arms enabling capabilities exist which can be identified through historical analysis. This chapter also establishes that the primary focus of study will be the FCS equipped mechanized BCT, as opposed to Infantry BCTs

(IBCTs). The author emphasizes that the significance of the research is to further the Army's understanding of the combined arms method of war through identification of combined arms enabling capabilities.

Chapter 2 explores the nature of CAW, and through the use of synchronization theory explains how synchronization is the key process by which units are able to plan and conduct the simultaneous employment of a combination of arms, thereby benefiting from their synergistic effects. A traits and process model of CAW is introduced to establish a theoretical framework from which to describe CAW. Utilizing this theoretical model, the author describes CAW as both a set of capabilities that combined arms units must possess and a set of procedures they must execute in order to conduct effective combat operations on the modern battlefield.

Chapter 3 reviews the main historical developments of CAW from World War I to the present Iraq War, including World War II, Korea, Vietnam, and the Gulf War. The chapter focuses on major developments in the areas of combined arms concepts, organizations, and tactics. Chapter 4 details the 13 combined arms enabling capabilities that mechanized BCTs need to possess to be successful on the modern battlefield. Chapter 5 speculates on how the operational environment might look in 2015, since this is when the first FCS equipped BCT becomes fully operational. Additionally, it examines the 2015 operational environment against the 13 combined arms enabling capabilities outlined in Chapter 4. The author concludes that a new military threat model, the Extremist Guerrilla Army, will be the dominant threat model in 2015. Chapter 6 describes the FCS program, examining the organic combined arms enabling capabilities that FCS BCTs will possess. The author identifies five critical capability gaps after

analyzing the enabling capabilities that FCS equipped BCTs are programmed to have, versus the 13 that the author maintains are critical for all BCTs. These five capability gaps have to do with: 1) a need for better on-the-move communications, 2) protection from nuclear contamination, 3) specialized engineer vehicles for route clearance, 4) an assault bridge variant of the FCS armored vehicle, and 5) a larger information operations (IO) presence within the unit.

This study arrives at seven findings. The first involves the idea that CAW is a unique method of warfare. The second finding concerns the notion of the Extremist Guerrilla Army as a new post-Cold War threat model, an idea that could become the basis for new Army doctrine. The final five findings involve areas in which FCS will not be fully capable in the dynamic operational environment of 2015. The study also makes seven recommendations. The first seeks to elevate the status of CAW to a much higher level of importance within the Army. The second promotes the idea that the Extremist Guerrilla Army should be adopted by TRADOC as a new post-Cold War threat model. The final five are recommendations for mitigating potential capability gaps in areas which the FCS BCT, as currently planned, will not be fully capable in the dynamic operational environment of 2015.

Background and Context

With the advent of mechanization in World War I, CAW has become the primary method of war employed by the U.S. Army. Since World War I, combined arms related technologies and doctrinal concepts have continued to evolve. An example of an advancement in CAW is the use of helicopters during the Korean and Vietnam wars and the doctrinal development of the concept of vertical envelopment.

Along with the need to understand technological and doctrinal changes in combined arms operations, the need to understand changes to the operational environment is just as important. In 1989, the Cold War between the U.S. and U.S.S.R. ended. After the collapse of the Soviet Union, a rapid change began in the operational environment for U.S. forces. The recent adoption by the U.S. Army of a new doctrine highlighting full spectrum operations is an example of a key development in response to this change in the operational environment. The doctrine of full spectrum operations implies that conventional units must be capable of conducting operations simultaneously against both high and low intensity threats. This doctrinal change by the Army further underscores how the operational environment has changed since the end of the Cold War.

Problem Statement

Given that there have been steady developments in combined arms since the evolution of mechanization in World War I, and that the Army's operational environment has changed considerably since the end of the Cold War, can we be certain that FCS equipped BCTs will possess the correct combined arms capabilities? Is it possible that the two factors of continual developments in CAW and changes to the operational environment will create a situation where FCS equipped BCTs have capability gaps between what they are supposed to be able to do and what they are actually capable of doing?

Primary and Secondary Research Questions

Although tremendous developments in understanding the nuances of CAW have been made since World War I, there still remains room for further analytical research.

This is a subject with relatively few published works supporting it directly, indicating there is room for much more intellectual study. In addition, there are likely gaps in knowledge which need to be explored and their findings exploited for their potential technological and doctrinal value. The majority of the previous research in the field has focused on defining the subject and understanding its key developmental components through a chronological framework. This paper will extend that research through the answering of one primary research question and two secondary questions. The primary question is whether developments in mechanized CAW and changes to the operational environment will lead to combined arms capability gaps in future FCS equipped BCTs. The first secondary question this paper will answer is what the operational environment look like in the 2015 timeframe. The second secondary research question is what capability gaps will FCS BCT's possess.

Assumptions

There are several important underlying assumptions the author must accept as true in order to move forward with this project. First, the author assumes that there are broad, overarching developments in CAW since World War I, which, once identified, will lead to an understanding of unique ground unit combined arms enabling capabilities. The existence of these capabilities will be central to this work. Having established these capabilities in Chapter 4, a subsequent assumption by the author is that the Army will continue with its plan to field FCS equipped BCTs. Regardless of the name chosen by the Army (FCS or otherwise), the author assumes the Army plans to ultimately replace its heavy tanks and infantry fighting vehicles with much lighter FCS vehicles, and that both the Heavy BCT (HBCT) and Stryker BCT (SBCT) will someday merge into a single type

of common BCT equipped with FCS vehicles. Furthermore, a third assumption that must be entered into is that the author will be able to establish a fairly accurate picture of what the Army's operational environment will look like in the 2015 timeframe.

Definition of Terms

Several terms will need to be clearly defined at the beginning of this thesis. First, the author defines Combined Arms Warfare as a method of warfare that seeks to closely integrate different military arms to achieve mutually complementary effects. Put more simply, through employing a combination (two or more) of arms together at the same time on the battlefield, ground units are able to benefit from the synergistic effects (may also be understood as complementary effects) of these arms. Furthermore, "arms" are understood to be combat arms branches of the Army (infantry, armor, field artillery, aviation, engineers, air defense artillery, or special operations forces) or any of the six U.S. Army doctrinal warfighting functions (movement and maneuver, fires, intelligence, sustainment, command and control, protection).² In addition, the concept of CAW can further be broken down into its three main components: 1) combined arms concepts; 2) combined arms organization; and 3) combined arms tactics (also called combined arms operations).³

The definition of the term Operational Environment (OE) will also be important to this thesis. Although fully accepted into U.S. Army doctrine in FM 3-0, *Operations*,⁴ Joint Pub 1-02 defines the OE best, indicating it is a composite of all conditions, circumstances, and influences affecting the employment of military forces or capabilities that bear on the decisions of the unit commander.⁵ The operational environment includes conventional and unconventional threats.

Finally, and central to this thesis, the term Combined Arms Enabling Capability must be defined. As the term indicates, combined arms enabling capabilities are those capabilities that enable combined arms operations. They are those capabilities most critical for units to possess if they are to conduct effective combined arms operations in the challenging operational environment of 2015. For example, in order to conduct a mechanized combined arms attack, units must be able to communicate while moving forward on the battlefield. Therefore, communicating on the move is a combined arms enabling capability.

Limitations

This thesis intends to make important advancements to the understanding of CAW, specifically with regard to the FCS program. However, the time allotted to conduct research for this project was only five months, in order to complete it within the Command and General Staff College's prescribed time period for its master's program curriculum. Additionally, the author's inexperience in conducting original research may have limited his access to research sources of the kind more readily accessible, and prevented access to important, but difficult to locate sources.

Scope and Delimitations

This study will analyze selected historical developments in CAW, beginning with the time period of World War I and continuing through 2008. However, it will focus primarily on technological and doctrinal changes that have enabled developments in mechanized combined arms operations, and will not attempt to cover all aspects of CAW history or development (such as combined arms training). With regard to understanding

changes in the Army's operational environment, it is limited to the timeframe covering the years since the end of the Cold War. Additionally, this study will deliberately not address topics such as the Army's overall force mix and size.

Significance of the Research

The importance of this thesis topic is twofold. First, this research has tremendous potential to advance the understanding of combined arms warfare in general and U.S. Army combined arms operations in particular. An identification of what capabilities are intrinsically combined arms enabling capabilities further solidifies definitions of CAW; what is it and is not. Identified enabling capabilities may also have the potential to become new tasks for unit combined arms training. Secondly, conclusions reached in this paper may lead to changes in organizational structure (force design), new technology developments, or doctrinal changes for future FCS equipped BCTs. Any capability gaps that are identified should, at the very least, stimulate discussion among FCS program managers, and might possibly lead to changes in program objectives. Additionally, with respect to time, a thorough study of this subject now (2008) will likely greatly help FCS program managers. If the first FCS equipped BCTs are to become operational as early as 2015, then senior decision makers will make final "capability decisions" in the 2008-2010 timeframe. Any capability gaps identified now will focus future FCS program development, saving time and resources in the long-term.

Research Methodology

The research typology (methodology) employed in this thesis is similar to that of a program evaluation, but does not match exactly the steps taken in a true program

evaluation. The program being evaluated (to a limited degree in this study) is the Army's Future Combat System (FCS). This research study utilizes some aspects found in a normal program evaluation, with the additional heavy emphasis on analysis of historical combined arms operations.

This study's principal argument is that there exists specific combined arms capabilities essential to modern combined arms operations. Historical study of CAW since World War I supports this argument, and leads to the conclusion that there are 13 enabling capabilities all mechanized BCTs must possess, as depicted below in Figure 1. Chapter 4 discusses these 13 capabilities in detail, through the lens of military history. First though, Chapter 2 describes CAW's basic components, outlining the important role of synchronization, as well as promoting the notion that CAW needs to be elevated to a much more prominent role within Army doctrine.

Combined Arms Warfare Enabling Capabilities

- 1 – On The Move Communications**
- 2 – Airborne Command & Control**
- 3 – Close Air Support (CAS)**
- 4 – Ground Based Indirect Fires**
- 5 – CBRNE Protection**
- 6 – Ground LOC Sustainment**
- 7 – Ground Resupply**
- 8 – Aerial Resupply**
- 9 – Night Fighting**
- 10 – Gap Crossing**
- 11 – Vertical Flight Attack Aviation**
- 12 – Vertical Flight Lift Aviation**
- 13 – Information Operations**

Figure 1. The 13 Combined Arms Warfare Capabilities

¹Department of the Army, FM 3-90, *Tactics* (Washington, DC: Government Printing Office, July 2001), A-1.

²Department of the Army, FM 3-0, *Operations* (Washington, DC: Government Printing Office, February 2008), 4-1.

³Jonathan M. House, *Toward Combined Arms Warfare: A Survey of 20th-Century Tactics, Doctrine, and Organization*, (Fort Leavenworth, KS: Combat Studies Institute, U.S. Army Command & General Staff College Press, 1984), 2-3.

⁴FM 3-0, *Operations*, p 1-1.

⁵Department of Defense, JP 1-02, *Dictionary of Military and Associated Terms*, (Washington, DC: Government Printing Office. April 2001, Amended Through September 2007), 394.

CHAPTER 2

COMBINED ARMS WARFARE DEFINED

I am tempted indeed to declare dogmatically that whatever doctrine the Armed Forces are working on now, they have got it wrong. I am also tempted to declare that it does not matter that they have got it wrong. What matters is their capacity to get it right quickly when the moment arrives.

Michael Howard, Military Author and Historian¹

Before we begin to look at CAW from a historical standpoint, let us take a moment to further describe it. As stated in Chapter 1, CAW is an approach to warfare that seeks to closely integrate different military arms to achieve mutually complementary effects. By employing a combination of arms on the battlefield – two or more together at the same time and location – units are able to benefit from their synergistic effects. Yet, exactly how does a unit employ a combination of arms to create a synergistic effect? How does the process work?

The purpose of Chapter 2 is to further describe CAW. The chapter begins by utilizing three separate modern descriptive approaches to do so: 1) a synchronization approach, 2) a systems approach, and 3) a traits and process approach. Charts are included for each approach, visually depicting how each applies to the combined arms method of war. Each of the three approaches gets at the problem of describing CAW from a slightly different perspective, and each offers a different framework. The chapter concludes with the author ultimately choosing the traits and process approach as the best framework from which to hang his list of critical enabling capabilities – capabilities which are described in Chapter 3 through the use of historical military case studies.

A Synchronization Approach to Describing Combined Arms Warfare

One way to describe CAW is as a military application of the concept of synchronization. Synchronization theory can help us understand CAW. Synchronization can be described simply as “a practice in timekeeping which requires the coordination of [different] events to operate a system in unison.”² Timing is the most critical aspect of conducting effective synchronization. A good example of synchronization can be seen in the orchestra conductor who works to keep all of his various instruments in time. Systems with their component parts synchronized are said to be “synchronous” or “in sync.” These individual component parts are kept in synchronization through their ability to start and stop at just the right time. Using an orchestra as an example, the conductor keeps the entire orchestra synchronized by ensuring each instrument section starts and stops playing music at the correct time. In CAW, a commander uses an execution matrix as his conductor, ensuring each component of his unit (his available forces and capabilities) stays synchronized throughout the execution of the battle. A commander’s available forces and capabilities include not only his subordinate units (his available forces), but also include his combat multipliers such as close air support (CAS) and Navy or Air Force electronic warfare assets (his available capabilities).

In the civilian world, the concept of synchronization is not normally thought of as having to do with military operations. Historically, synchronization has been employed in fields having to do with music, navigation, transport, and communications. Of course, with the advent of the satellite-based navigation system called GPS, synchronization now occurs on a global scale, due to the use of GPS enabled timekeeping systems embedded

in so many machines.³ Other, less known uses of synchronization can be found in flash photography, encryption systems, automotive transmissions, and computer software.

In CAW, synchronization happens through the staff planning process. The most critical tool in the staff planning process used to develop a unit's operations order (OPORD) or operations plan (OPLAN) is the wargame, which results in the production of a synchronization matrix.⁴ Through the use of the wargame, a unit synchronizes its future battle plan. The synchronization matrix not only captures the main points from the wargame, but most importantly it becomes the base document used in the battle's execution phase to synchronize (to keep together in time) all the unit's available forces and capabilities in the upcoming battle. The genesis of combined arms synchronization begins in the planning process, culminating in a synchronization plan, normally expressed as a synchronization matrix. The synchronization plan (matrix) may continue to be refined up until the start of the battle.

On the battlefield, the overwhelming application of all available military combat and combat support forces and capabilities happens only if all are synchronized in the wargaming process. When various combat and combat support arms work in harmony they are considered to be synchronized. Wargaming is the point in the planning process where multiple, parallel subprocesses or activities converge into one single plan.⁵ Synchronization is an output of the wargaming process, but is not itself an actual step in the staff planning process. This may account for the random success of units at synchronizing their combat and combat support efforts while at Army training centers, such as the National Training Center or Joint Readiness Training Center. Neither is there currently any type of computer software program designed specifically to facilitate

synchronization during either the staff planning process in general or wargaming in particular.

While “timing” is the most critical aspect of synchronization, the second most important aspect is speed. Key here is the understanding that for all component parts to stay synchronized, they must all keep consistent speeds, so that one part does not get ahead of the others or lag behind.⁶ In CAW this translates into the requirement for all subordinate units maneuvering on the battlefield to maintain a consistent rate of speed. For example, on a linear battlefield, when a BCT is on the attack, if one battalion is not able to stay abreast of another, then an exposed flank may be created. This is when the previously synchronized battle plan begins to break down and unravel for most units, as an enemy force may detect the exposed flank and seize the opportunity to attack. While maintaining consistent speed among component parts is important to maintaining good synchronization, it is also difficult to control. In CAW, a commander can compensate for the near impossibility of units maintaining consistent speeds at all times during the battle through extensive pre-battle wargaming against multiple enemy courses of action, which leads to the development of multiple branches and sequels to a unit’s battle plan. Only the BCT that has done extensive pre-battle wargaming against multiple enemy courses of action and has developed multiple branches and sequels to its battle plan – anticipating every possible contingency – will be able to keep its battle plan from un-synching itself during the battle.

The third and final aspect of synchronization involves the notion that effective synchronization may often require a master and slave relationship.⁷ Synchronization often involves having a single master and one or more slaves who attempt to maintain the

same timing (starting and stopping), speed (rate of movement or action), and location as the master. The speed, action, or location of the master can determine any combination of the speed, action, or location of the slaves. Using the example of an orchestra, the conductor's written music score serves as the "master", while the conductor works hard to make certain the "slaves" (the instrument sections) keep pace with the music score. For Army combined arms operations, the master is the commander's battle plan, which is normally referred to as the friendly course of action (COA), and the slaves are the commander's available forces and capabilities which must keep pace with the friendly COA. Figure 2 outlines the three main aspects of synchronization.

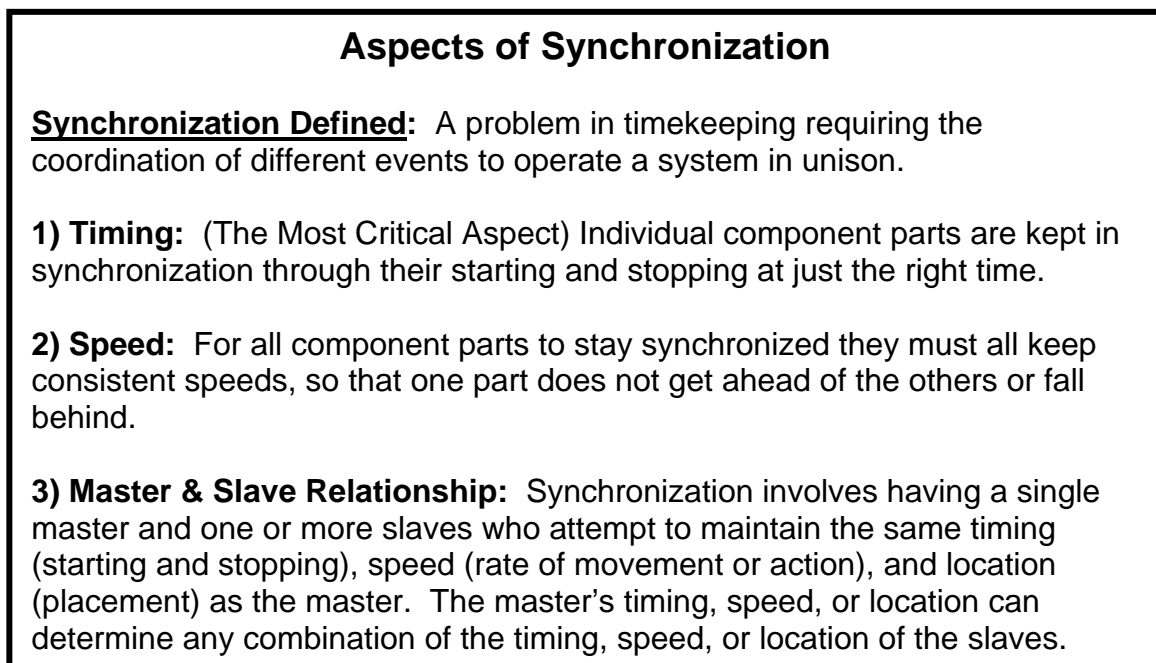


Figure 2. Key Aspects of Synchronization

Another, often misunderstood point is that synchronization happens in the planning phase, not the execution phase.⁸ Synchronized execution of the combined arms

team in the planning phase leads to success on the battlefield in the execution phase, by causing the right effects to happen at the right time, speed, and or location. Well synchronized combined arms operations accomplish the commander's intent and achieve expected outcomes on the battlefield. However, in the execution phase of an operation units are simply following the synchronization plan (the execution matrix), which was created in the planning phase as a result of the wargaming process.

Complete lack of synchronization, or even just poorly planned synchronization, can prevent a commander's available forces and capabilities from being synchronized throughout the execution of the battle. This can cause partial or complete failure on the battlefield. For example, a BCT's inability to synchronize artillery fire so that it can effectively suppress the enemy along its axis of attack is rarely due to poor execution. Rather, ineffective efforts at synchronization can be directly linked to the quality of a unit's staff planning process, its wargaming, and its synchronization plan (embodied in its execution matrix).

Also worth noting here is the tremendous challenge in CAW of synchronizing combat service support (CSS) functions with those of the combined arms team. It is essential that the six CSS functions (manning, arming, fixing, fueling, moving, and sustaining) are synchronized with the maneuver plan which is to be executed by a unit's combat forces. The six CSS functions should be included in the unit's wargaming and written into its execution matrix. However, CSS units are often neither present at the wargaming process, nor attend the combined arms rehearsal conducted by the unit prior to the battle.⁹ Within a combat unit such as a BCT a separate CSS rehearsal is often conducted. Excluding CSS functions from the BCT's execution matrix (its primary

synchronization plan) and not including CSS participation in the unit's combined arms rehearsal risks breaking the master and slave relationship between combat forces and CSS forces, thereby further degrading synchronization efforts within the BCT. A separate CSS rehearsal is effective at synchronizing CSS support to the BCT to a certain degree, but truly seamless CSS support cannot take place without inclusion of the CSS functions' critical events into BCT wargaming and the unit's execution matrix. For example, units capable of fully synchronizing CSS functions with their maneuver plan through full CSS participation in the wargaming process are better able to develop effective CSS trigger points, which are fundamental to getting logistics to forward combined arms units in a timely manner.¹⁰ Figure 3 depicts how BCTs synchronize their combat arms functions, CSS functions, and staff functions with the commander's friendly COA through wargaming, rehearsals, and the unit's execution matrix.

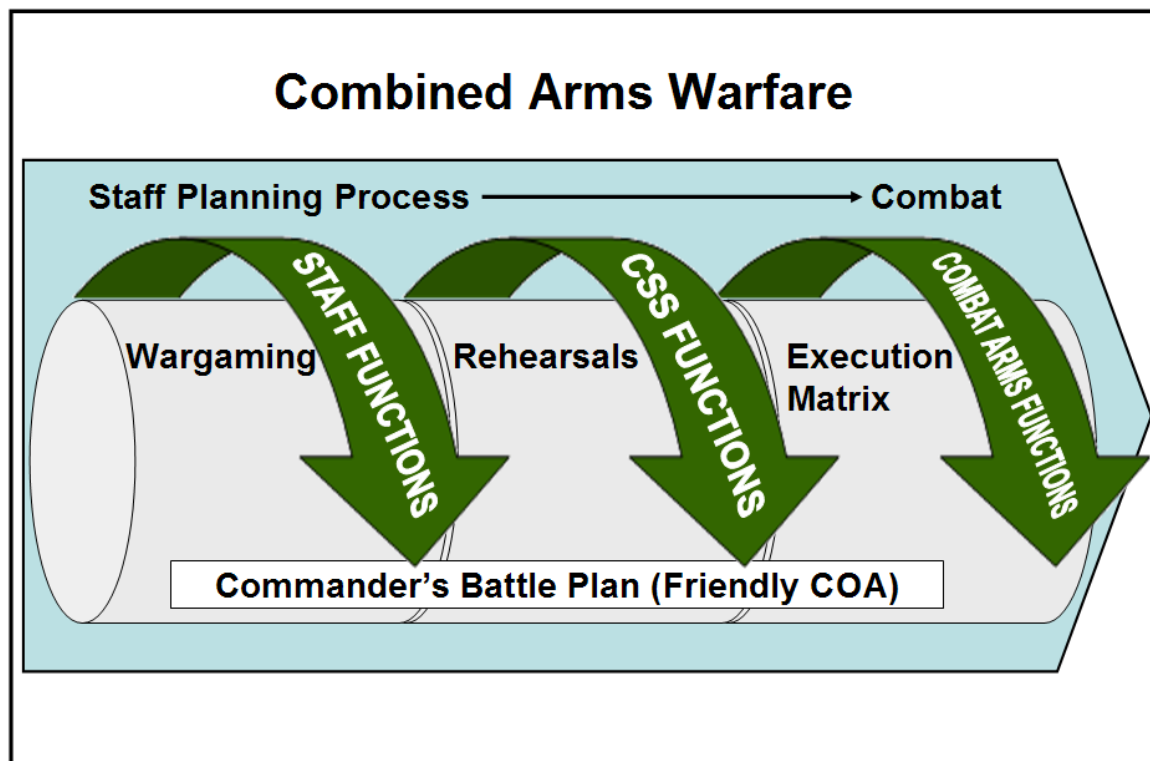


Figure 3. A Synchronization Approach to CAW

A Systems Approach to Describing Combined Arms Warfare

Another way we can describe and understand CAW is to view it through the lens of systems theory. Through the application of systems theory we are better able to understand the manifold complexities of combat organizations. A unit capable of combined arms operations can therefore be seen as a combined arms system.

Finding prominence in the second half of the 20th Century, systems theory – also called systems thinking – is a means of explaining complex organizations as an organized collection of parts (or subsystems) which are highly integrated together and acting collectively to accomplish an overall goal. While systems theory can be applied to engineering just as easily as it can to business management, its primary focus is on

problem solving within large, intricate organizations. Specifically, systems theory focuses on identifying and resolving system inefficiencies, an aspect which makes it ideally practicable for military use.

Unique to systems theory is its large-view perspective towards understanding and describing an organization's complex relationships, both internal and external. In the 1975 book, *General Systems and Organization Theory*, Kent State University scholar Arlyn J. Melcher states,

Systems theory provides a wholistic [sic] perspective by focusing attention on the dynamics of relationships. It puts in bold relief that traditional analyses, using comparative statistics, often lead to partial analyses and misleading conclusions.¹¹

Melcher's comments put into perspective the importance of viewing large organizations from a holistic perspective, since only through this approach do we begin to understand that relationships between subordinate organizations (subsystems) are also affecting the overall organization's efficiency and effectiveness.

Before systems theory, a large organization such as an Army BCT could only be understood as its component parts; for example, its headquarters company and subordinate battalions. However, utilizing systems theory, we begin to see more than just the obvious component parts (subsystems) of an organization. Now, relationships between organizational subsystems are brought to light, relationships which affect organizational efficiency and effectiveness. The prominent role played by relationships leads to the realization that good communications between subsystems is essential, highlighting the importance of establishing strong information exchange systems, information control systems and synchronization mechanisms among subsystems.¹²

Figure 4 depicts the basic systems model as it applies to a generic organization.

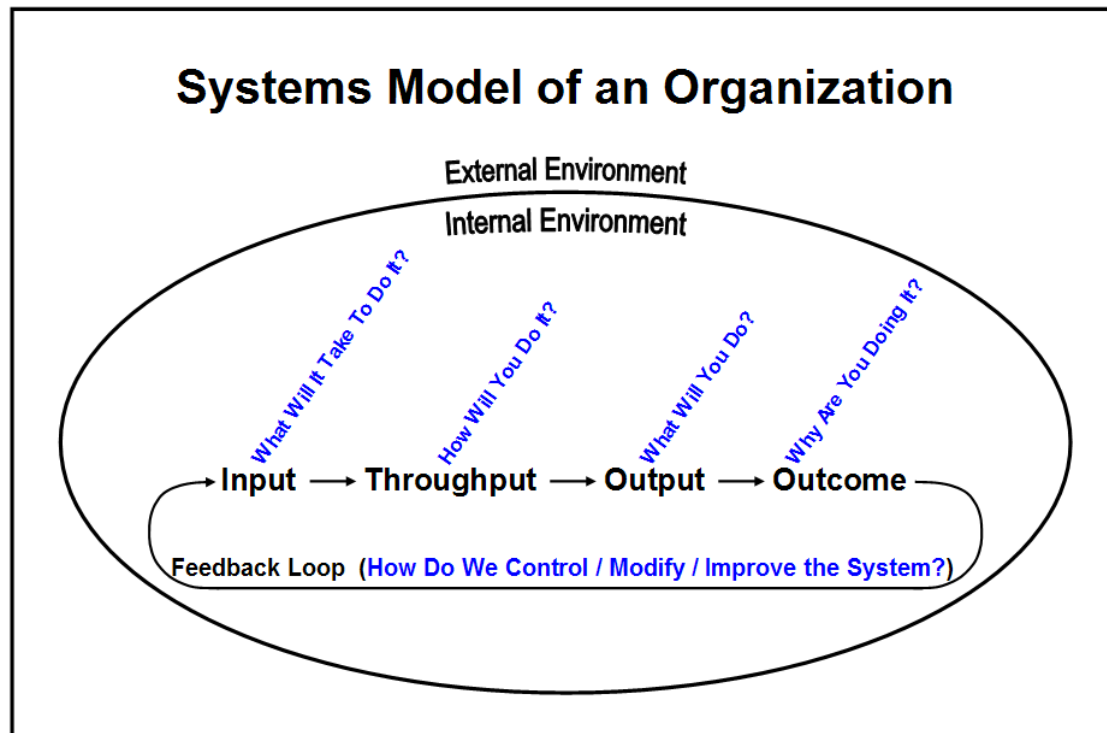


Figure 4. General Systems Model of a Large, Complex Organization

Source: Figure created by author. Information taken from *The Systems Diagram* (Online at <http://www.technologystudent.com/designpro/system1.htm>), Copyright V. Ryan © 2001-06, Accessed November 20, 2007).

While it might seem logical that the first step in applying systems theory to any organization would be to label the organization's component parts (its subsystems), this is not the case. Instead, the first step is to overlay the organization onto the systems model. In doing so, it can be determined how closely the organization's structure is aligned with the systems model's seven critical functions, key functions which make up the structure of all large, complex organizations. These functions are: 1) the external environment, 2) the internal environment, 3) the input producing function, 4) the throughput producing function, 5) the output producing function, 6) the outcome producing function, and 7) the feedback loop.

Before looking at how the systems model might apply to a combined arms capable unit, we must first understand the three cornerstone principles essential to modern systems theory. First, a practitioner of systems theory normally approaches any large organization with the belief that it is “sustained by communicative processes and by the transmission of information.”¹³ In other words, systems theory recognizes that for organizations to be healthy they need to possess strong mechanisms for exchanging ideas internally. In the modern Army there exist many clearly delineated paths for a unit to communicate information, to include its command structure (chain of command), tactical radios, email, cell phones, and even a secure internet. However, commanders must do more than just build effective communications systems. They must also work hard to limit the bureaucratic processes within their units which block or inhibit communications. For example, a lack of bandwidth, inexperienced personnel, and new computer systems which require extensive amounts of operator training before being used effectively are all things which may act to impede effective communications within a unit.

The second concept central to modern systems theory is that for organizations to be controlled most effectively they must possess efficient feedback loops designed to adequately route information back to organizational leaders. This feedback process provides leaders with the critical information they need to control the myriad aspects of the organization.¹⁴ In Army units today combat commanders have multiple feedback loops from which to gain information on the daily health and direction of their units. These feedback loops include after action reviews, daily staff update briefings, and daily verbal interactions between commanders and their subordinates. Through deliberately

building and maintaining strong feedback loops within their units, commanders can most effectively control their organizations.

The third principle central to modern systems theory is that as an organization's subsystems become less dependent the entropy within the organization increases.¹⁵

Entropy can be described in this case as the measure of an organization's disorder, the process or trend of an organization moving towards disorder, and even the measure of energy not available for work.¹⁶ This means that to prevent increases in organizational entropy – organizational disorder, work flow disruptions, and subordinate organizations “doing their own thing” independent of what the boss wants done – leaders must create dependencies between organizational subsystems. The two means available to unit commanders to create and maintain these positive dependencies include: 1) structuring organizations so that no subsystem (subordinate unit) is completely independent of others; and 2) establishing procedures which require subsystems to communicate ideas, exchange information, and seek approval before being allowed to execute certain tasks.

Figure 5 depicts how the systems theory of organizations applies to combined arms capable Army units. Using the example of a BCT, one can see how the BCT staff attempts to use the throughput function to synchronize the various inputs (primarily information), in order to ultimately produce an output of efficient and effective combined arms operations. The importance of synchronization cannot be overstressed. Through the broad-picture lens of systems theory we can now see how synchronization plays a central role in CAW in general and combined arms capable units in particular. Lastly, the diagram depicts how the feedback loop function provides the BCT commander the critical information he needs in order to daily execute effective control over the conduct

and direction of his unit, as well as to make corrective modifications to internal unit procedures.

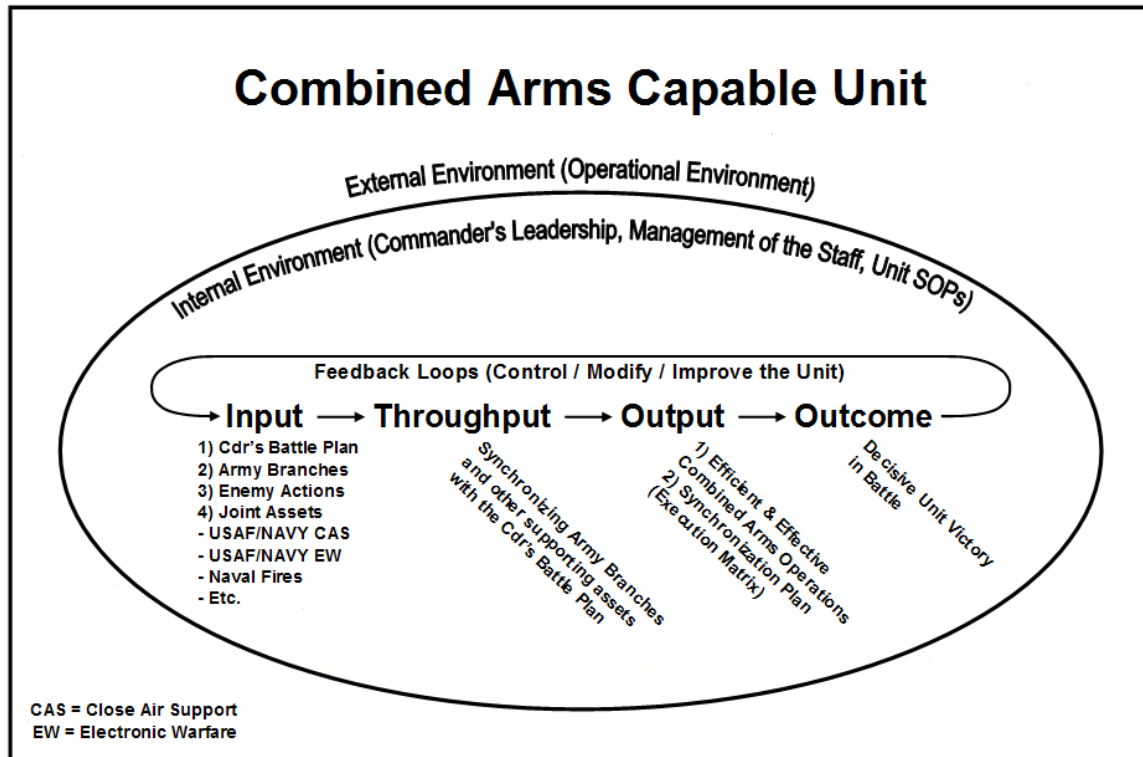


Figure 5. Systems Model Applied to Combined Arms Capable Units

A Traits and Process Approach to Describing Combined Arms Warfare

The third and final method used in this chapter to describe CAW is a traits and process approach. This approach builds on the insights gained through earlier research in this chapter on synchronization theory and systems theory. It becomes a logical next step in our understanding of CAW as we move from the micro view of CAW as a simple matter of synchronization, through the broader understanding of CAW as a set of functions and subsystems with interdependent relationships offered by systems theory.

While having an awareness of how both synchronization theory and systems theory apply to CAW, neither addresses the problem of describing CAW from a truly big-picture, macro viewpoint. The traits and process approach is the best model available to describe CAW at the macro level. In the final analysis, all three models are valuable, as synchronization theory gets at the heart of CAW by highlighting its main challenge of synchronization, systems theory brings to light the broader issues of unit functions and subsystem relationships, while the traits and process approach provides a background on which to view CAW from an historical standpoint.

Offering a strong theoretical framework from which to hang historical military observations, the traits and process approach to describing CAW theorizes that CAW can be described as both a set of traits and a set of processes. Using an either/or approach cannot adequately describe it. Other military concepts have also been described utilizing a traits and process theoretical approach; two in particular employing similar analogies include: 1) describing the military profession as a combination of art (traits) and science (processes); and 2) describing military leadership as both a set of skills to be learned (traits) and relationship to be nurtured (processes).

When overlaying the traits and process model onto CAW we see that the best way to describe CAW traits are to list them as specific capabilities combined arms units must possess in order to conduct effective combined arms operations. Conversely, when applying the model to describe CAW processes, we can list the procedures that combined arms units must execute in order to conduct effective combined arms operations. While the primary purpose of this research study is to identify, through historical case study, CAW capabilities, Figure 6 also includes a short list of potential CAW procedures. One

can see how these procedures could be easily converted into individual, team, and collective tasks to be trained and developed at service academies, branch schools, and combat training centers.

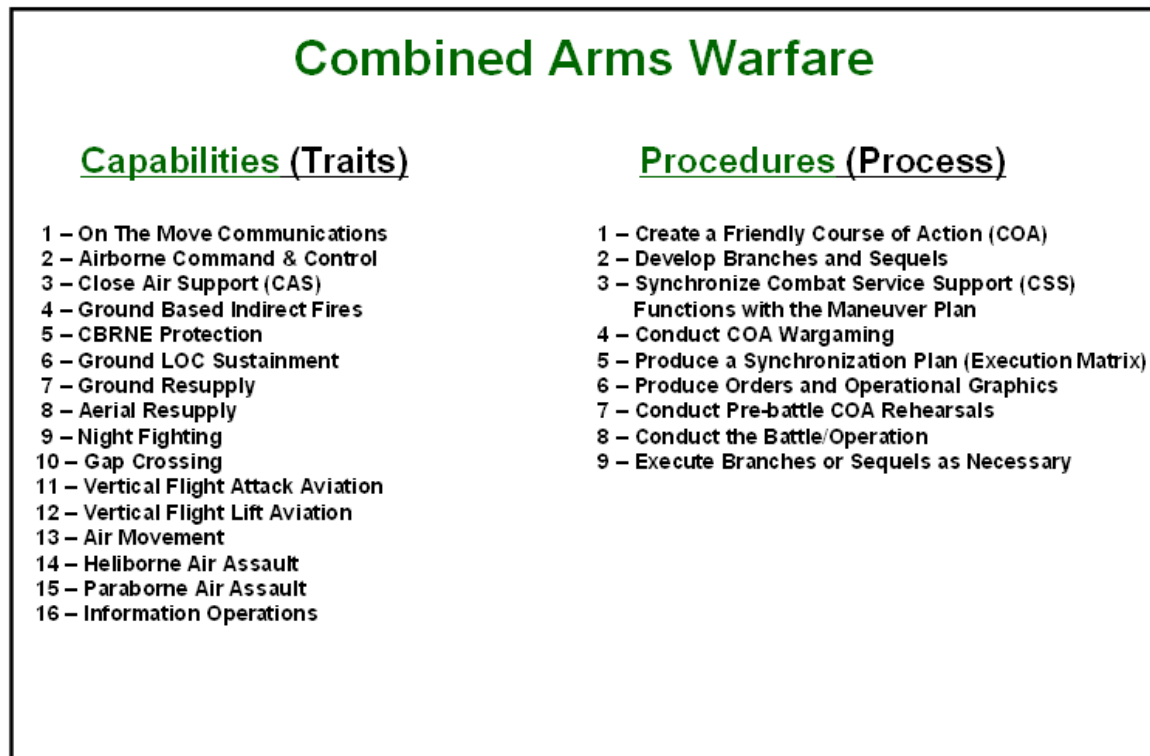


Figure 6. The Traits and Process Model Applied to Combined Arms Warfare

Viewed in an even larger context, CAW can be understood to be a method of conducting warfare, one which offers a noticeable advantage over any adversary.

Examples abound in military history which illustrate that an Army capable of conducting this method of warfare has a superior advantage over an Army which cannot. Chapter 3 provides many of these examples. Stated another way, the Army which can best synchronize its various arms through the method of CAW has a marked advantage in

war. However, current Army doctrine does not specifically spell out that CAW is a method of warfare.

In fact, the Army's understanding of CAW continues to stagnate. Interestingly, while the 2001 version of FM 3-0, *Operations*, recognizes that, "The fundamental basis for the organization and operations of [all] Army forces is combined arms", and the 2008 version of FM 3-0 states "Applying combat power depends on combined arms to achieve its full destructive, disruptive, informational and constructive potential."¹⁷ Neither make the mental leap that it is a method of conducting warfare. Yet, taken together, these comments naturally lead one to believe CAW to be not only a method of warfare, but rather one of extreme importance. Still, very little in the way of effort seems to have been made by the Army to research CAW. While its importance in military history has been cataloged to some degree by civilian and military book authors, there seems to have been no official efforts by the Army to further analyze it or to otherwise elevate it in importance above any other general war related concept. Even in the 2008 version of FM 3-0, CAW does not hold an especially significant place, being unprominently located at the tail end of the chapter titled "combat power."¹⁸

Army doctrine should be modified to clearly state that CAW is the U.S. Army's primary method of conducting warfare. This new doctrine should also include the information spelled out in Figures 6, 7 and 8. By elevating the doctrinal definition of CAW from its current minor role of "the synchronized or simultaneous application of several arms" to a more prominent role of "the Army's primary method of conducting warfare" the Army will radically change how it views and conducts war.

Moreover, this new doctrine needs to become the core doctrine for Army Transformation in general, and the FCS program in particular. Similar to how the late Cold War doctrine of Air Land Battle contributed to dramatic improvements in the Army's ability to wage war, so too could a new doctrine based on CAW further transform the Army, ushering it into the 21st Century as an ever more capable and decisive land combat force. It would provide the doctrinal foundation and needed direction for the FCS program. As part of a lighter and more agile force, FCS units will serve as a dramatic departure from current, much heavier, less agile, and more logistics intensive legacy units. Only a new base doctrine, one which values speed in decision making, emphasizes the close integration (synchronization) of different military arms, and which understands combat units as complex systems will be able to maximize the unique mix of manned and unmanned capabilities offered by FCS.

Just as important as the adoption of this new doctrine is the need for the Army to link CAW to a clearly identifiable wartime endstate. An army's peacetime endstate normally focuses on deterrence, whereas a wartime endstate should focus on winning wars. From the perspective of backwards planning, one can see how important it is to establish a desired wartime endstate before identifying combined arms capabilities and procedures (those depicted in Figure 6). In addition, without a clearly definable wartime endstate it will be very difficult to measure the effectiveness of any doctrinal method of warfare.

Finally, the argument that Army doctrine should be linked to a specific threat (i.e., the Cold War's USSR, al-Qaeda, and China, to name a few) only results in short lived threat-based methods of warfare which perpetuate a cycle of preparing for the last war.

For instance, while it could be argued that the Cold War era AirLand Battle doctrine helped prepare the U.S. Army to win the 1991 Gulf War against an Iraqi army equipped and organized along the Cold War era Soviet model, it certainly did not prepare the U.S. Army to fight the complex type of irregular warfare first encountered in the 2002 Operation Enduring Freedom in Afghanistan or to respond to the Arab insurgency encountered in late 2003 as part of Operation Iraqi Freedom in Iraq. It is better to link Army doctrine to our expanding understanding of the general nature of warfare (in this case, a wartime endstate), than to a particular threat, since today's threat models are evolving too rapidly and are often difficult to define (i.e., that posed by the Chinese).

Figure 6 depicts a wartime endstate which addresses the three main outcomes a commander may choose to focus on, outcomes which relate to the enemy, the terrain, or the civilian population. The best outcome with regard to the enemy is that the enemy force is decisively defeated. The best outcome in relation to the terrain is that friendly forces are able to maintain their freedom to maneuver unhindered across it, while the enemy loses its ability to maneuver. Lastly, the best population related outcome is that the civilian population is favorably influenced to support friendly forces in the accomplishment of their mission.

In Figure 7, CAW is shown as the primary method (the core doctrine) by which the Army would be best able to carry out its primary mission of fighting and winning 21st Century wars in order to achieve its desired wartime endstate. This process begins with the Army establishing its wartime mission statement and desired wartime endstate. Figure 7 depicts a generic wartime mission statement. This is not the official U.S. Army mission statement, but rather a generic one used for the purpose of demonstrating the

relationship between the Army's mission statement and its primary method of warfare.

As for the endstate depicted, it also is a generic model used to illustrate its relationship to the Army's primary method of warfare (in this example, CAW).

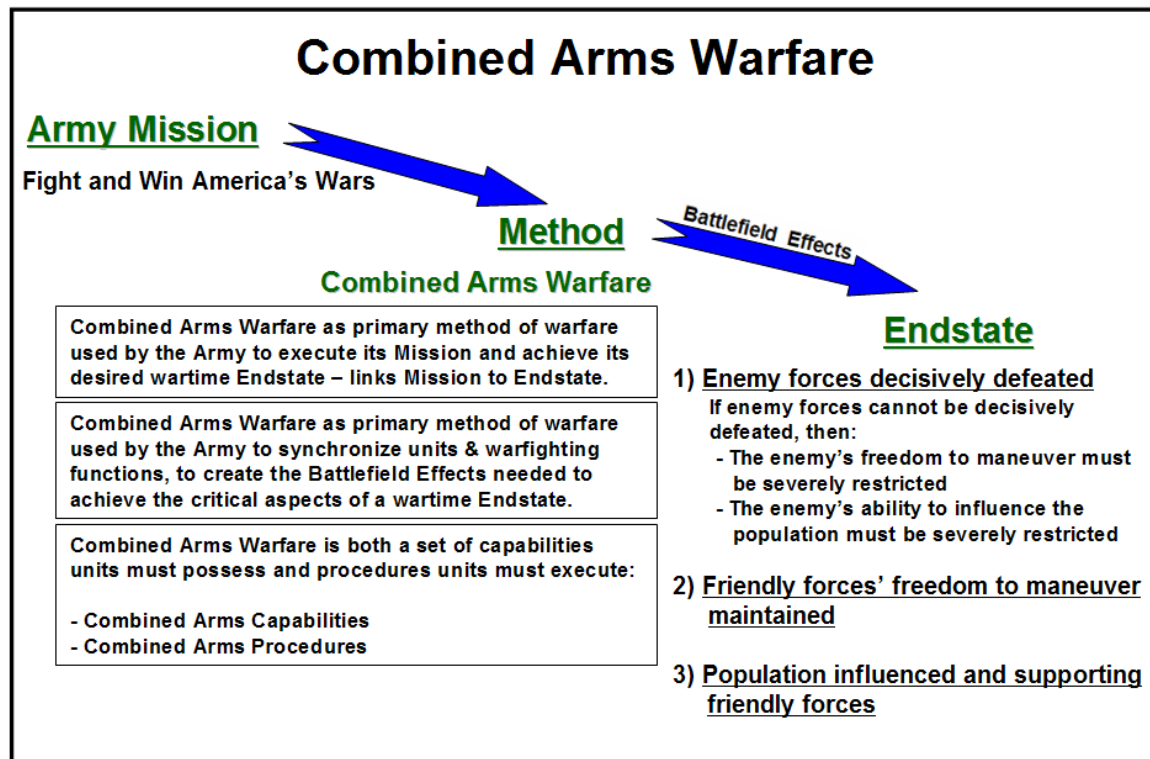


Figure 7. CAW as the Army's New Core Doctrine (Method of Warfare)

As a final point on the subject, Figure 8 outlines the linkage between specific CAW capabilities and the three components of a wartime endstate. If CAW is to be the Army's primary method or warfare used to achieve its wartime endstate, then there must be a direct linkage between the two. Of note here is that there exists today only one CAW capability, Information Operations (IO), that a commander can use to influence the civilian population – to win their hearts and minds. Some may argue that in addition to IO, psychological operations (PSYOP) can also be used. However, while PSYOP is

certainly a component of IO, it is still an individual arm (such as, infantry, aviation, special forces, etc.) and not a CAW capability in and of itself. Time will tell if the skillful use of this one CAW capability (IO) is all a commander needs in order to achieve an endstate of positively influencing the civilian population.

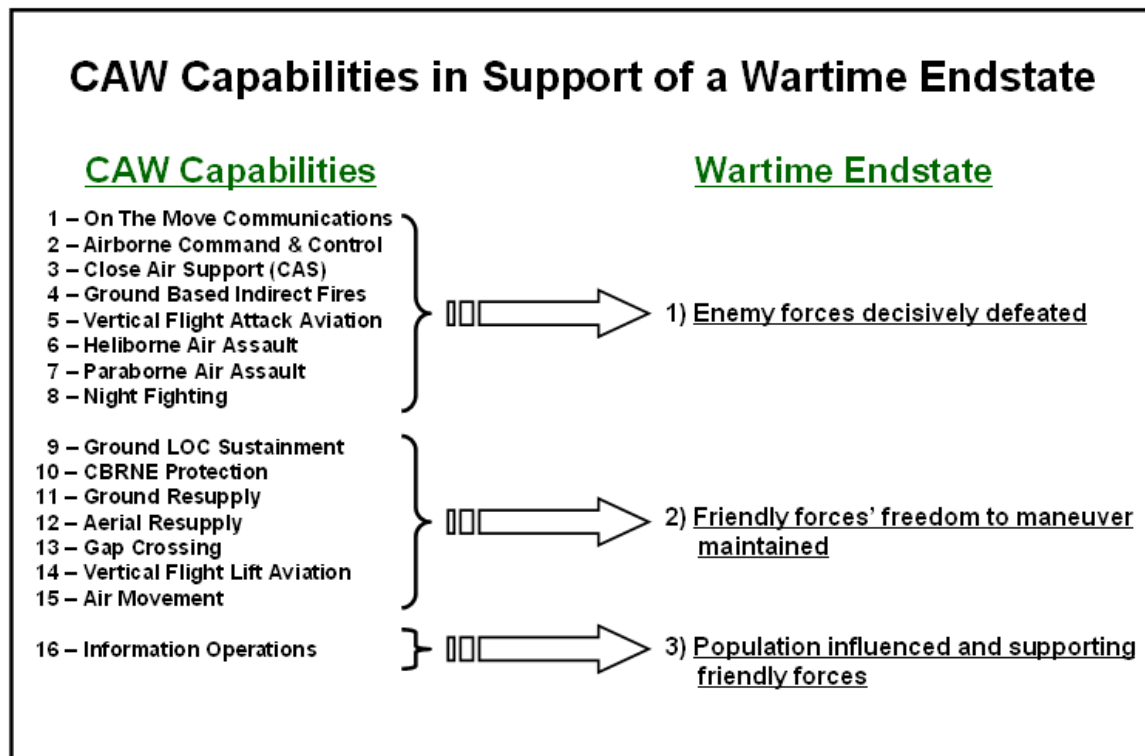


Figure 8. Linkage Between Individual CAW Capabilities and a Wartime Endstate

¹Michael Howard, "Military Science in the Age of Peace," *RUSI Journal*, Edition 119 (March 1974), 7.

²Supply Chain Glossary, "Synchronization," Planvisage website, Online at <<http://www.planvisage.com/resources-glossary.html>>, Copyright © 2007 Planvisage (accessed November 10, 2007).

³Institute of Navigation, "Session E4: Time Keeping & Synchronization," Institute of Navigation website, Online at <<http://www.ion.org/meetings/>>

past/gps2001/e4.html>, Copyright 1995-2007, Institute of Navigation, Inc. (accessed November 10, 2007).

⁴Army War College, Department Of Military Strategy, Planning And Operations. Campaign Planning Primer AY 07 (Carlisle Barracks, PA. 2007), 31.

⁵Synchronization Workflow Pattern, Online at <<http://is.tm.tue.nl/research/patterns/synchronization.htm>> (accessed 10 November, 2007).

⁶Ken Lanyon, “Getting In Synch – Part 1”, *The Recording Website*, Copyright 2002-2003, Recording Institute of Detroit/Robert Dennis, Online at <<http://www.recordingwebsite.com/articles/sync1.php>> (accessed November 11, 2007).

⁷Ibid.

⁸John D. Rosenberger, LTC, “The Burden Our Soldiers Bear: Observations of a Senior Trainer (O/C)”, Global Security.org website, Online at <http://www.globalsecurity.org/military/library/report/call/call_95-11_ctc1-01.htm> (accessed November 10, 2007).

⁹Lyle D. Hohnstine, LTC, “FSB Logistics Training at the CTC and Home Station”, Global Security.org website, Online at <http://www.globalsecurity.org/military/library/report/call/call_95-11_ctcs2-4.htm> (accessed November 11, 2007), 1.

¹⁰Ibid.

¹¹Arlyn J. Melcher, *Theory and Application of Systems Theory: Its Promises, Problems, and Realizations*, In *General Systems and Organization Theory: Methodological Aspects*, Edited by Arlyn J. Melcher, Kent, Ohio: Kent State University, Center for Business and Economic Research, 1975, 3.

¹²Emilo Roxin, “Dynamical Systems With Inputs,” In *Proceedings of the Symposium on System Theory: New York - 1965*, Edited by Jerome Fox. Brooklyn, New York: Polytechnic Press of the Polytechnic Institute of Brooklyn, 1965, 105.

¹³Eugene P. Wenninger, “Entropy, Equilibrium, and Organizations: Problems of Conceptualization,” In *General Systems and Organization Theory: Methodological Aspects*, Edited by Arlyn J. Melcher, Kent, Ohio: Kent State University, Center for Business and Economic Research, 1975, 29.

¹⁴Richard Bellman, “Mathematical Aspects of the Theory of Systems,” In *Proceedings of the Symposium on System Theory: New York - 1965*, Edited by Jerome Fox. Brooklyn, New York: Polytechnic Press of the Polytechnic Institute of Brooklyn, 1965, 25.

¹⁵Eugene P. Wenninger, “Entropy, Equilibrium, and Organizations: Problems of Conceptualization,” 26.

¹⁶"Entropy," Encyclopedia Britannica, 2008, Encyclopedia Britannica Online, Online at <<http://www.britannica.com/eb/article-9032727>> (accessed 10 January, 2007).

¹⁷Department of the Army, FM 3-0, *Operations* (Washington, DC: Government Printing Office, June 2001), 4-7.

¹⁸Department of the Army, FM 3-0, *Operations*, (Washington, DC: Government Printing Office, February 2008), i.

CHAPTER 3

COMBINED ARMS WARFARE HISTORY

I formed the theory that the true role of the infantry was not to expend itself upon heroic physical effort, nor to wither away under merciless machine-gun fire, nor to impale itself on hostile bayonets, nor to tear itself to pieces in hostile entanglements . . . but on the contrary to advance under the maximum possible protection of the maximum possible array of mechanical resources in the form of guns, machine-guns, tanks, mortars and aeroplanes; to advance with as little impediment as possible.

General Sir John Monash, World War I Australian Corps Commander¹

Sir John Monash's quotation above is enlightening, as it puts into perspective the benefits to be gained through the proper use of combined arms. When used together, the weaknesses of individual arms are masked by the strengths of others.² For example, the vulnerability of exposed infantry is masked by the physical protection of armor and the vulnerability of armor to antitank guns is masked by the infantry's ability to quickly locate and destroy these weapons. Infantry forces in the all-arms attack have a much greater chance of success closing with and destroying the enemy when supported by the suppressive effect of direct and indirect fires and able to take advantage of the protection offered by armor.

Developing an accurate appreciation for the evolution of Combined Arms Warfare (CAW) best begins by reviewing its main historical highlights. Chapter 3 focuses on this historical perspective, looking at the history of CAW from World War I to the present. It focuses on major developments in the areas of combined arms concepts, organizations, and tactics. This chapter sets the stage for Chapter 4, which details the 13 CAW capabilities that modern mechanized BCTs need to possess to be successful on the modern battlefield.

A Brief History of Combined Arms Warfare

The concept of “combined arms” was well known within the military profession before the start of the Great War in 1914. Many military historians recognize the first battle of Breitenfeld, Germany, in September, 1631, as the birthplace of combined arms combat. During this battle, the Swedish King Gustavus Adolphus led Protestant forces in combat against the German Catholic forces of the Catholic League. Adolphus utilized “infantry brigades deploying a new triad of infantry musketeers and pikemen, field artillery and heavy cavalry in a manner that combined fire and manoeuvre, missile and shock in a single system of warfighting.”³ Employing this new form of synchronized all-arms combat, Protestant forces were able to achieve their first major victory against Catholic forces during the Thirty Years War (1618-1648).

Two important points emerged from the Swedish victory at Breitenfeld. First, Adolphus organized his brigades to give them their own organic artillery pieces, resulting in combined infantry and artillery units. Units were no longer dependent on separate artillery units for their artillery support. Second, Swedish forces were extremely well trained on procedures for synchronizing individual arms on the battlefield, enabling them to employ a highly effective “sequence of musketry volleys, pike charges, cavalry shock, and barrages from field guns” to overwhelm and ultimately defeat the Catholics.⁴

Within the annals of military history, the importance of the 1631 battle of Breitenfeld cannot be overstated, and this battle has proven a defining moment for the study of CAW. In an Australian land warfare study titled “From Breitenfeld to Baghdad: Perspectives on Combined Arms Warfare”, military historian Michael Evans argues,⁵

Breitenfeld showed how it was possible – through combining the three arms of infantry, artillery and cavalry – to wield firepower and offensive shock in battle.

The innovations demonstrated at Breitenfeld became an inspiration and blueprint for European soldiers from Turenne to Frederick the Great. During the French Revolutionary and Napoleonic Wars between 1792 and 1815, the triad of infantry, cavalry and artillery was eventually refined into the self-contained *corps d'armée* system – a system that has been described as ‘the French secret weapon of the Napoleonic Wars’.⁶

Breitenfeld remains at the heart of the combined arms method of warfare, providing the best early example for how an army capable of synchronizing its various individual arms on the battlefield has a marked advantage in war.

World War I (1914-1918)

One factor worth noting leading up to World War I is the industrial revolution. Begun in the late 18th Century, the industrial revolution brought forth mechanization in the form of automobiles, agricultural tractors, steam ships and airplanes. It allowed for the large scale production of these and other arms, such as rifles and explosives. This revolution in industry paved the way for the first use of large metal machines in war and for waging war on a grander scale than ever before.

World War I served as a major catalyst for change with regard to CAW concepts, organizations, and tactics. Since much of the war on the Western Front consisted of large infantry assaults across No-Man’s Land, one of the most important changes had to do with how infantry units were equipped. Both sides pushed combined arms capabilities down to the infantry squad level. Infantry units were issued hand grenades in large quantities for the first time, a form of short range indirect fire ideal for trench warfare. In addition, infantry units employed light automatic rifles, rifle launched grenades, flame throwers, sniper rifles, and trench mortars (typically mortars 3 inch or less in diameter).⁷

The result of these changes was to increase the firepower of infantry units, making them ever more lethal on the battlefield.

The machine gun played a prominent role in the war. Both sides created machine gun companies and used machine guns extensively. However, due to their heavy weight and attendant poor mobility, machine guns were initially not moved forward with attacking infantry, and were used primarily in a defensive role.⁸ Only later in the war were light, portable weapons introduced. Mortars too, like machine guns, due to their weight, were not normally moved forward with assaulting infantry units. Both were used in a combined arms role, but primarily in the defense. Interestingly, at the outbreak of the war many armies categorized machine guns as artillery weapons, since they were seen as too large, heavy and clumsy for use by infantry units.⁹

The use of chemical weapons was another major development in the war. While the first large scale use of gas was conducted by the Germans against the Russians on the Eastern Front in January, 1915, the attack had little effect, as the gas performed poorly in the cold winter weather.¹⁰ The Germans next used gas on the Western Front on the evening of 22 April, 1915, simultaneously against two French and one Canadian divisions along a four mile front near the French town of Langemarck, in the Ypres Salient. However, the Germans viewed gas as not another arm to be synchronized in the attack with infantry and artillery, but rather as a unique technology (a type of wonder weapon) that might overcome the Allied defenses and lead to a quick victory.¹¹ By the end of the war two types of artillery-delivered gas shells had been developed: a “non-resident” or non-persistent vapor which lasted on the battlefield only for a short time (the

best choice if one wanted to seize a specific piece of terrain); and “resident sticky liquids” (best used to deny terrain to the enemy for long periods of time).¹²

Of course, the real challenge with the employment of gas was how to successfully integrate it into the attack. This was particularly true for the Germans on the Western Front, where the prevailing wind directions were from west to east. Famed military author Martin Gilbert explained the problem:

...the Germans experienced considerable difficulties in combining a gas attack with an infantry advance. Without a favourable wind, the gas was a danger to the advancing troops, who found themselves moving forward into their own poison cloud. With a sudden unfavourable wind it became a positive danger, blowing back into the trenches where men waiting to go over the top to exploit the success of the gas were themselves affected by it, and incapacitated.¹³

While the problem of synchronizing a gas attack with that of an infantry assault may be partially overcome by the use of chemical protective equipment (gas masks, etc.), the unpredictability of the wind’s speed and direction still make timing the assault difficult. After repeated attacks by both sides, gas was seen as simply a new technology of war, “a new weapon [that] had become a part of the accepted method of warmaking.”¹⁴

Of course, the use of gas was just one more attempt to overcome the defensive nature of the war. Some Allied military officers during the 1914-1916 timeframe believed that defensive technology had developed far more quickly than offensive technology, and that this had caused the tactical stalemate of trench warfare.¹⁵ The overriding tendency of both the Allies (the Entente Powers) and the Central Powers then became finding ways which would allow ground forces to once again return the art of maneuver back to the battlefield.

The Germans answered the challenge of how to return mobility to the battlefield by producing a new offensively oriented doctrine centered on “infiltration” or “soft spot” tactics. Developed between 1916 and 1918, infiltration tactics were designed to rapidly cut Allied lines of communications and isolate forward units.¹⁶ By 1918 the German Army had trained 70 divisions in a special course designed to instruct units on the new tactics.¹⁷ In 1918, during the spring offensives, Germany began to have significant success utilizing these new tactics on the Western Front. Had it not been for a lack of transport mobility for the foot-bound infantry (either vehicles or horses) and lack of a clear strategic vision, German forces would have likely quickly turned their small tactical gains into much larger operational or strategic victories.¹⁸

German units employing infiltration tactics often began their assaults with a well planned “short but intense [artillery] bombardment designed to isolate, demoralize, and disorganize” enemy units.¹⁹ Using aerial photographs to pinpoint Allied targets, German artillery concentrated their fire on critical nodes such as command posts, radio and telephone centers, and mobility chokepoints (i.e., bridges) along lines of communications leading to frontline units.²⁰ The effect of these precise indirect fires was to isolate frontline enemy forces physically and sever communications links with their higher headquarters.

Next, a combined arms attack, consisting of assaulting infantry battalions and supporting direct fire artillery, was launched to disrupt Allied rear areas and destroy isolated frontline units. The German assault force consisted of two echelons. First echelon units attempted to infiltrate undetected past enemy units in columns of small, squad size groups. Seeking gaps through enemy units and fighting in a decentralized

fashion, first echelon units bypassed centers of enemy resistance. Second echelon units would then systematically eliminate bypassed frontline Allied units, often employing direct fire artillery and flamethrowers to do so.

From a combined arms perspective, German infiltration tactics were successful on the battlefield for several reasons. First, they closely synchronized fires with maneuver; artillery with infantry. Second, German assaults often began with the use of chemical gas mixed with traditional artillery rounds. The gas added a third element to which the enemy had to react (German infantry moving forward, artillery attacking precise targets, and gas). Third, they were able to integrate numerous infantry support weapons during the assault, such as the light machine guns, flame throwers, and direct fire artillery. In fact, as part of these new tactics, infantry units were fielded “large numbers of stripped-down machine guns.”²¹ However, German infiltration tactics also contained flaws. Its three main flaws were a lack of mobility for infantry and artillery units, a lack of an armored platform for machine guns, and lack of armored protection for infantry forces.²²

The British, on the other hand, responded to the need for battlefield mobility by developing the tank, which emerged during World War I as a reaction to the stalemate of attrition style trench warfare. It was originally conceived and designed solely as a machine for breaching obstacles inherent to trench warfare, namely to crush wire and cross the gaps of enemy trenches. By the end of the war all major armies began to realize that the tank had the potential to forever replace horse cavalry units.

The British first employed tanks on the battlefield in a daylight attack on the morning of September 15, 1916, as part of the Battle of the Somme.²³ Forty-two tanks, working in groups of threes, were to destroy enemy strongpoints, allowing accompanying

infantry units to flow into enemy trenches.²⁴ Initial objectives included the villages of Les Boeufs, Morval, Gueudecourt, and Flers. Once these objectives were taken, horse cavalry units would rush through the gap created in the German lines and continue the attack, along with artillery and eight more tanks.

Only thirty-six of the forty-two tanks actually took part in the attack, presumably due to mechanical problems.²⁵ However, the initial psychological shock effect on frontline German forces was overwhelming, so much so that in their initial encounter with the vehicles, German soldiers described them as something akin to monsters which breathed fire (from machine guns and cannons protruding from side-mounted sponsons or “barbettes”).²⁶ The attack enjoyed local success, achieving a 3,500 yard penetration of the German lines. In the process though, all 36 vehicles were disabled, due to either mechanical breakdown, ditchings in rough terrain, or German artillery fire. Following the battle, reports of the previously secret vehicle instantly became front page news across the globe. Overall, the attack was considered one of the “most spectacular local victories on the Western Front.”²⁷

Following the successful debut of the tank at the Battle of the Somme, British and French forces launched plans to mass produce thousands of tanks. While the British made somewhat minor changes to their tank designs, the French, having not already invested in any particular design, struck out in a new design direction. Determining that the slow speed (no more than four miles per hour) and short operating range (no more than 25 miles) of British tanks would be inadequate for future breakthrough operations, the French produced several different tank designs, the most notably being the light Whippet tank, which had a speed of eight miles per hour and a range of 80 miles.²⁸

Command and control of tanks units on the battlefield was difficult. Tank unit commanders, like their infantry counterparts, normally held rudimentary rehearsals before the battle began. Once the attack commenced, subordinate tanks followed their commander's tank. Some British tanks had small, spark operated radios, but these had a range of only 200 yards and only worked when the vehicle was stationary and its engines were off.²⁹ Painted metal discs were also used by soldiers from inside tanks in an attempt to communicate with other tanks. As for communications with the infantry, it is rumored that infantrymen were sometimes issued hammers so they could pound on the outside of the tank and get the crew's attention.³⁰ Contact with outside infantry units was important, since tanks that lost contact and moved too far ahead of supporting infantry were often easy prey for German infantry. In fact, without friendly infantry in support, small teams of German infantry were able to stalk and kill the slow-moving tanks at close range.

The Germans were slow to respond to the British use of the tank. They admitted that the tank had a terror inducing psychological impact on frontline troops, but did not view it as an especially effective weapon. It has also been argued that the Germans "regarded tanks as specialized weapons that they could not afford to maintain."³¹ This view may have been formed in part by the fact that all 36 Allied tanks had either broken down or been disabled in the Battle of the Somme. However, the Germans did develop a man-portable 13.3mm antitank gun, called the Tank Abwehr Gewehr M1918, able to penetrate Allied armor out to 300 meters.³² They also produced their own tank called the A7V, but by war's end had fielded only a very small number, somewhere around 20 total vehicles.³³ Additionally they utilized about 170 captured British and French tanks.³⁴

Military historian and author John Keegan best summarized the German tank problem by stating, “Germany’s failure to match the Allies in tank development must be judged one of their worst military miscalculations of the war.”³⁵ However, even if the German Army wanted to match the Allies in tank production, it is extremely unlikely it would have been able to; since German industry lacked access to the necessary resources (raw materials) needed to make large amounts of steel.

By late 1917, the Allies had finally produced enough tanks to begin to turn the tide against the Germans and their massively deep defensive lines. The Battle of Cambrai on November 20-28, 1917, included 324 Allied tanks, which led to a six mile penetration of the German lines.³⁶ Cambrai’s large use of tanks also earned it the distinction as the World War I battle in which the British Tank Corps finally “became an arm in its own right.”³⁷ Following Cambrai, the next major battle in which Allied tanks played a central role was the August 8, 1918, Battle of Amiens, during which 400 British tanks broke through the German defenses, which led to the Allies finally crossing the Hindenburg Line the following month.³⁸

While some historians argue that the tank did not play a decisive role in World War I, it certainly helped to bring warfare into the industrial age. In addition, it restored mobility to the battlefield, reinforced the importance of maneuver, and returned the initiative from the defending force to the attacking force. The tank also reintroduced the importance of the element of protection in CAW. Reminiscent of medieval armored knights on horseback attacking fortified positions, the tank brought to the forefront the importance of having armor protection when attacking an enemy force in the defense.

Overall, the slow speed of the World War I tank was its main shortcoming, since this allowed the German Army time to bring forward reserves from their rear areas, causing Allied units to exhaust themselves fighting a constant stream of rested, counterattacking German units. However, towards the end of the war, the Allies were beginning to overcome this lack of speed by employing large numbers of tanks on the battlefield. Allied tank production was also finally catching up to demand. While the World War I tank did overcome the primary obstacles of trench warfare (barbed wire and trenches), making trench warfare obsolete, it was used throughout 1916-1918 in too much of a “penny packet” fashion. Allied forces employed tanks in support of infantry attacks, as opposed to employing infantry units in support of large tank attacks – which is what the Germans would do in World War II with their armored spearhead type of warfare.

Indirect fire technology and tactics also advanced significantly during the war. On the Western Front, both sides experimented with how best to provide artillery support for advancing infantry and both achieved substantial improvements in indirect fire accuracy. Of course, on the Allied side, accurate artillery fire in support of advancing tank units was also essential, as it suppressed or neutralized German artillery firing in a direct fire mode against the tanks.

An enormous number of large caliber indirect fire systems (both artillery and mortars) were employed on the Western Front. This was largely due to the fact that while light artillery pieces were effective against infantry in open terrain; they had very little effect against trenches or fortresses.³⁹ Because World War I was primarily a defensive struggle, with relatively stable defensive lines, both sides could well afford to permanently emplace extremely large caliber systems, with the expectation that they

would not have to be moved very often. Their ability to deliver immense shells into enemy territory was valued much more than their mobility. This was at least the case until 1917, when successful large scale offensive operations by both sides began to increase. However, initial availability of these systems was an issue, as large caliber howitzers and mortars (pieces of 300 mm or more) were not always kept in an army's inventory. One way the Central Powers attempted to initially solve this problem of a large demand for high angle firing systems was to strip large guns from fortresses in friendly countries and send them to the front.⁴⁰ Many large caliber guns had to be shipped to the front via rail and then once there embedded into permanent concrete firing platforms.⁴¹ However, in the end, both sides were able to overcome their deficiencies in large indirect fire systems by mounting large caliber guns on rail cars. This dramatically increased the mobility of large caliber artillery, since they could then move wherever the railroad line was laid.

Of course, large caliber systems were not the only important aspect of indirect fire during World War I. Even more important was the role played by quick firing, mobile artillery. Most armies began the war with some amount of quick firing, light artillery for suppression. The Germans initially dominated numerically in this category of weapons, but eventually the Allies' production of these systems caught up.⁴² As the war on the Western Front progressed and both sides developed their own forms of breakthrough tactics, the need for these mobile, lightweight systems became paramount. Guns ranging from 105 to 210 mm were preferred, as they were hard hitting, yet light enough to be relatively mobile.⁴³ When conducting offensive operations, these guns would initially be positioned in large formations one to two miles behind the front. Once they began firing

their primary task was to suppress enemy forces, preventing aimed fire by the enemy, and allowing friendly forces to move forward unhindered.⁴⁴ A secondary mission was to damage enemy trench lines. Once friendly forces reached the enemy trenches, the artillery would transition to a creeping barrage 100 to 300 meters in front of advancing infantry. This tactic highlights the old saying, “Artillery conquers, infantry occupies.”⁴⁵ Other artillery missions included harassing fire and counterbattery fire.

While it is true that both the use of large caliber artillery and the use of quick firing, mobile artillery were important developments during the war, of even more significance were the numerous technical improvements by which artillery accuracy and lethality was increased. Military historian Jonathan House notes important technical developments, stating:

Many of the procedures that are common place to artillerymen today were developed painfully during the period 1914-1917: establishing forward observer techniques, measuring and compensating for the effects of weather and worn barrels, and using ammunition from the same production lot to ensure that successive volleys fell in the same general area.⁴⁶

These changes facilitated the trend toward precision fire and increased lethality. Other technical improvements included the widespread use of recuperator mechanisms for countering howitzer recoil, the American design of a more streamlined artillery shell that followed a more consistent trajectory, rangefinders, aiming circles, elevation quadrants, wind indicators, and deflection boards, to name a few.⁴⁷ Taken together, by 1917, these improvements meant that instead of requiring large initial artillery barrages lasting hours or even days in the opening stage of a battle, lesser amounts of more accurate artillery fire could achieve the same effect within minutes of the start of a battle. Not requiring a

long initial opening barrage also meant that units could now better utilize the element of surprise, launching their infantry assaults simultaneously with artillery strikes.

Another technical trend had to do with mapping. Having detailed maps is essential to conducting accurate indirect fires. Along the Western Front, both sides conducted aerial photographic mapping, to improve firing battery accuracy. The British, in particular, used this information to develop an accurate grid system from which they could register their guns and adjust fires during battle.⁴⁸

Communications was another area where technical developments helped to advance accuracy. Initially, artillery observers moving forward with infantry would lay wire behind them, so as to be able to talk with firing batteries in the rear via handheld telephones. As technology progressed and wireless radios began to be fielded to units, radios initially served as a backup to wire. Due to their unreliability, man portable radios were often not good enough to serve as the only means of communications.⁴⁹ Of course, a runner could always serve as a secondary means to pass messages to the rear. Later in the war, radios mounted in aircraft were another means artillery units had of coordinating their efforts with ground forces; however, these radio sets were still very primitive and this means of communications did not always work very well. Back on the ground, one tactic developed by the Allies late in the war that did work well was to move mobile communications nodes (trucks, with communications shelters) forward behind Allied infantry as they advanced. The vehicles would stay connected to firing batteries in the rear by wire, while communicating with forward observers by radio.

The final category of indirect fire's technical developments had to do with improvements in artillery lethality, due to the design and production of more lethal

artillery shells. The experience of the British Expeditionary Force (BEF) illustrates some of the many technical challenges which had to be overcome in this regard. While the Germans had fairly effective high explosive (HE) artillery shells from the outset of the conflict, the BEF encountered numerous problems bringing into production a safe and effective shell for trench warfare. At the beginning of the war the BEF only had shrapnel shells, which were very good against troops in the open, such as were encountered during the opening stages of the war.⁵⁰ However, once both sides established trenches and overhead cover, the BEF realized they needed HE shells, as this type was much more effective against dug-in forces. To fill this critical need the British designed and produced their own HE shell. However, once BEF artillery units began firing the new shell problems were immediately encountered. The fuses for the new shells were poorly designed and often caused shells to prematurely detonate inside the barrel of the gun, which normally resulted in death of gun crew members. In addition, due to the poor fuse design, up to one third of the new shells failed to detonate when landing, which littered the battlefield with hundreds of thousands of British duds.⁵¹ Ultimately, the British copied the fuse used in French HE shells, solving the problem.

The use of gas was another important tactic related to indirect fire. The employment of gas was meant to move infantry out into the open where they could be destroyed by artillery.⁵² For example, in ideal wind conditions, German gas was delivered either via canister from German lines or by artillery fire. It would gently drift over Allied positions and settle in low areas, causing Allied infantry to come out of their trenches. As the infantry exited to the rear of their trench lines and began to retreat they could not stop and take shelter in the available shell craters, as the gas would have settled

there too. This caused the infantry to remain standing as they attempted a lengthy retreat further to their rear, all the while being exposed to German artillery.

While the airplane emerged as a new weapon of war on the World War I battlefield, it had little effect on ground combined arms warfare. Not until World War II would the airplane emerge as a synchronized component of the ground-air team. Some of the factors preventing the establishment of effective ground-air coordination included a lack of established doctrine for the battlefield use of the airplane, a lack of lightweight specially designed aerial bombs, a lack of an effective bomb sight, and lack of two-way radio communications with ground personnel. While both the Allies and the Axis forces employed airplanes on the Western Front, the machine's primary contribution to ground combat was through aerial reconnaissance. Airplanes could quickly overfly enemy positions and return with photographs detailing the layout of their defenses. Other ground-related missions flown by airplanes include liaison, artillery observation, and strafing of ground targets with their machine guns – targets such as enemy columns or trench lines.⁵³ Of course, the airplane's primary focus was on achieving local air superiority during ground operations, in order to prevent enemy aerial reconnaissance, artillery observation, and strafing.

Airplanes did, however, conduct limited bombing of front-line ground targets during the war, albeit with little effect. At the beginning of the war, due to their speed and large load-carrying capacity, only lighter-than-air dirigibles were capable of carrying out aerial bombing of ground targets.⁵⁴ Later in the war, specialized airplane types were produced specifically for this mission. Military historian Martin van Creveld notes in his book, *The Changing Face of War*, that by war's end distinct differences began to appear

between those aircraft types designed specifically to serve as fighter aircraft and those designed to serve in a ground support role.⁵⁵ World War II would see the further refinement of aircraft designed specifically to operate in close support of ground forces.

One final development worth mentioning is the use of the tethered observation balloon. Both sides used observation balloons to conduct not only aerial reconnaissance, but also limited airborne command and control. During World War I, it was primarily artillery units which utilized observation balloons, in order to observe and adjust artillery fire. An observer in the basket of the balloon would use a telephone, connected via wire to the ground, to relay information to firing batteries. This allowed artillery forces to better synchronize their efforts with advancing infantry forces in the attack or to destroy attacking enemy forces when in the defense. Since a soldier in the basket of a balloon had good visibility up to 60 miles, balloons could be placed well behind the forward trace of friendly lines, normally five or so miles behind the lines.⁵⁶ Placing them far behind friendly lines also kept them within range of friendly airplanes, affording the best possible protection from enemy airplane “balloon busting” missions. The main lesson to be taken from the use of tethered observation balloons in World War I is that there is tremendous value in observing the fall of artillery shot from the air. In a static defensive conflict in particular, one in which artillery plays a dominant role, artillery units should always seek to observe and adjust indirect fire from the air.

Attempts at using balloons to synchronize combat operations on the ground serve to highlight an even larger problem of how to effectively command and control modern, mobile units. Central to the command and control problem is the issue of how to communicate among other units. Until the radio could be employed on a large scale (in

World War II), major challenges would persist with on-the-move communications, making mobile warfare extremely difficult to manage. Three World War I techniques of synchronizing operations are worth noting here. All of them deal primarily with synchronizing infantry with artillery, specifically at getting artillery units to fire upon and reduce enemy strongpoints within the path of the infantry. The first technique involved having infantry lay out wire, which allowed it to pass information by telephone back to friendly lines. This technique overcame the problem of having one's messenger pinned down by enemy fire and therefore unable to move to the rear.⁵⁷ Of course, as the infantry advanced the ever increasing lengths of wire were prone to breakage. Another technique, attempted by the British at the Battle of the Somme in 1916, involved holding infantry and artillery units to strict timelines, which was designed to negate altogether the need for communications between the infantry and artillery.⁵⁸ This technique did not work well either, as it led to many missed battlefield opportunities and fratricide.⁵⁹ The third technique attempted for mobile command and control was one pioneered by the Germans; decentralized leadership. During their offensives in 1918, German forces "decentralized the command system while providing the infantry with special, lightweight artillery and machine guns so that it could be pushed forward to deal with any opposition on the spot."⁶⁰ Of course, this technique too had its disadvantages, the first of which being the need to push forward artillery and machine gun ammunition over increasingly long distances. Other command and control techniques were also attempted, to include aircraft wing waving, dropping messages from aircraft, laying boards on the ground to signal to aircraft, and use by the infantry of colored rockets, but none proved reliable enough that it became the dominant form of communications.⁶¹

World War II (1939-1945)

While World War II served primarily to further refine and strengthen combined arms capabilities first introduced in World War I, it also introduced several novel combined arms concepts. Some World War II developments, such as German blitzkrieg tactics and improved ground-air cooperation can be seen as natural extensions to previously introduced World War I doctrinal, organizational, or technological advancements. Yet others, such as the addition of rockets to the realm of indirect fire and the establishment of airborne operations, were completely new cultivations.

Certainly, the greatest advancement in CAW during World War II was the German development and use of blitzkrieg tactics. Blitzkrieg, or “lightning war”, was a form of fast moving, highly mobile armored warfare. The brain child of German officer General Heinz Guderian and others, German blitzkrieg tactics can best be described as attacking with an armored spearhead to disrupt enemy organization. Armored spearheads attacked to break up an enemy’s defense into smaller pockets of resistance. Following this, infantry forces surrounded and destroyed each pocket of resistance individually. Enemy strong points were bypassed by lead armor units, in order that the tanks not get bogged down in heavy fighting and instead get into the enemy’s rear area quickly. Guderian served as a signal officer in World War I, and so understood the importance of radio communications. This experience led him to require that all German tanks possess radios, which allowed for their close cooperation and coordination with each other and with other arms during battle.

Key to the success of blitzkrieg was the creation of armored divisions capable of penetrating even the strongest enemy defense. Guderian argued that the real value to be

gained from the use of tanks would be wasted if they were to be placed in infantry divisions. Instead, he wanted large groups of tanks concentrated in armored divisions, acting as fast moving armored spearheads. In his book *Panzer Leader* Guderian wrote:

In this year, 1929, I became convinced that tanks working on their own or in conjunction with infantry could never achieve decisive importance. My historical studies; the exercises carried out in England and our own experience with mock-ups had persuaded me that the tanks would never be able to produce their full effect until weapons on whose support they must inevitably rely were brought up to their standard of speed and of cross country performance. In such formation of all arms, the tanks must play primary role, the other weapons being subordinated to the requirements of the armor. It would be wrong to include tanks in infantry divisions: what was needed were armored divisions which would include all the supporting arms needed to allow the tanks to fight with full effect.⁶²

Guderian's comments highlight his view that speed and cross country performance were the two central pillars upon which blitzkrieg relied upon for its success. As long as Germany's armored divisions were able to maintain their cross country performance by overcoming obstacles such as rivers and continue to move forward with speed, then blitzkrieg would work.

Another critical aspect to blitzkrieg was the notion that armored forces should attack at the enemy's weakest points. Before a major attack, German forces would test an enemy's defensive line, attempting to identify its weakest points. German armored divisions would then attack on extremely narrow fronts (even as narrow as 1,000 meters) called tactical thrust points (Schwerpunkt) and quickly exploit a breakthrough in their enemy's defensive line.⁶³

Germany's armored divisions fought as combined arms teams, and included infantry units and antitank guns in their formations. However, for the majority of their indirect fire support the Germans relied upon Junkers JU-87 Stuka dive bombers. This was due to the fact that slow moving German towed artillery was ineffective at

supporting the fast moving tanks. Remember too that throughout World War II only 10 percent of the German Army was mechanized, which meant that the vast majority of German artillery was towed, not self-propelled.⁶⁴ JU-87 Stuka dive bombers proved excellent at providing flying artillery support for the fast moving armored units, utilizing the technique of vertical dive-bombing to knock out pinpoint targets with great effect. Not only were Stukas better able than artillery to support the fast moving German armored forces, but their vertical dive-bombing resulted in extreme accuracy, enabling them to accomplish with one or two bombs what would normally take an entire squadron of conventional bombers to do.⁶⁵ Of course, the weakness in relying so heavily on aerial delivered indirect fire is that ground forces are dependent upon good weather for fire support. Because of this, German forces normally launched major attacks during periods of good visibility. As for the infantry soldiers within the divisions, transportation was always an issue. In fact, only a small portion rode in armored half-track type vehicles, while the rest either rode trucks, walked or rode horses.

In response to German blitzkrieg tactics, the U.S. Army organized, trained, and deployed tank destroyer units, which saw action in both the North African and European theaters. A total of 56 tank destroyer battalions saw action in the European theater alone, comprising six percent of the total personnel in the four U.S. field armies in the European theater.⁶⁶ While some battalions had towed antitank guns, the majority of tank destroyer battalions were comprised of antitank guns on an M4 Sherman chassis. The most prevalent system was the M-10, which had an obsolete naval 3 inch gun mounted in an open turret atop an M4 chassis. For the most part, the battalions were tank destroyer pure, although each did have an engineer platoon and reconnaissance elements to

facilitate mobility operations. Still others had one infantry squad organic to each platoon of each antitank company, but none had their own organic mortars or artillery.

Lieutenant General Lesley McNair held overall responsibility for the U.S. Army's tank destroyer doctrine development in the early 1940s. He, like others, tended to hold the view that stopping German tanks was a special tactical problem which required a specialized solution.⁶⁷ McNair's thoughts on how to stop the German tank are best expressed in this 1940 quotation:

The tank was introduced to protect against automatic small arms fire, which was developed so greatly during and since the [First] World War. Its answer is fire against which the tank does not protect – the anti-tank gun. That this answer failed [against the Germans in 1940] was due primarily to the pitifully inadequate number and power of French and British anti-tank guns, as well as their incorrect organization.⁶⁸

It is obvious that McNair envisioned a defensive strategy against German tanks, since the antitank gun, whether mounted or not, is very much a defensive weapon. In addition, McNair's antitank response made no attempt to beat the Germans at their own game of mobile armored warfare. In fact, in arguing for a strategy overly dependent upon the antitank gun, McNair was inadvertently arguing against an integrated combined arms approach towards defeating the Germans.

Following McNair's guidance, the Army worked to develop a type of antitank doctrine that would seek not to pit U.S. tanks against German tanks, but rather to bring dedicated U.S. tank destroyer units against German tanks.⁶⁹ According to tank destroyer doctrine at the time, tank destroyer units would be maintained at division or higher as a "semi-independent" mobile reserve, ready to "react en masse, in fire-department style, to enemy armored threats anywhere along the line."⁷⁰ As a result, regular U.S. forces would then be able to detach themselves from engagements with German tanks – or avoid

them altogether – and continue offensive operations. Of course, in reality things never worked this way. For example, once battalions were deployed and assigned to a division they were almost immediately broken apart, with individual companies being reassigned to augment subordinate regiments. Christopher Gabel put it best in *Seek, Strike and Destroy* when he stated, “Under these circumstances, tank destroyer doctrine was fundamentally unworkable and justifiably abandoned.”⁷¹ Additionally, since tank destroyer battalions were not organic to a division, corps, or army, they often became “orphaned” once deployed, causing units to experience severe shortages when attempting to requisition manpower, spare parts, and the specialized ammunition for their main guns.⁷² It seems obvious now that it would have been better for the U.S. Army to have simply upgraded the main guns on all Sherman tanks rather than to create tank destroyer battalions.

The main problem with U.S. tank destroyer doctrine was that it was poorly formulated from the beginning. Its foundational idea, that tank destroyers could defeat German armored units by themselves in a non-combined arms approach, was its undoing. The doctrine may have been somewhat plausible when the idea was first developed in 1939-41, when most world tanks could be penetrated by cal .50 machine guns, but by the time tank destroyer units arrived in combat a new generation of more heavily-armored German tanks had been fielded that were relatively invulnerable to the tank destroyers. Ultimately, tank destroyer doctrine, consisting of specialized units operating semi-independently, proved to be a poor match for the U.S. Army’s combined arms approach to war.

As French and British forces had already learned earlier in the war, German tanks operated closely with infantry, artillery, airplanes, and antitank guns. A 1943 Army Ground Forces' Observer Report stated:

Typically, fearsome 88-mm antiaircraft-antitank guns flanked by lighter pieces, and protected by infantry, covered all German tank movements from concealed overwatch positions. Even when on the offensive, the Germans made every effort to support tank elements with antitank and artillery pieces...any attempt by tanks (or tank destroyers) to attack German mechanized elements, even those that appeared to be isolated and vulnerable, was likely to bring down a murderous converging fire from concealed antitank guns. Any allied attack that did not provide for the neutralization of this antitank defense risked defeat and disaster.⁷³

The thinking that drove tank destroyer doctrine was fundamentally flawed, since it was too specialized and it neither addressed how to counter a German approach to war which included closely integrated and supporting battlefield arms, nor did it include a means to counter German antitank defenses. However, it should be noted that tank destroyers did add needed capabilities to Allied units wherever they were assigned. In addition to reinforcing units with additional firepower, they also served as excellent self-propelled assault guns and, when required, could serve effectively in a direct-support artillery role.⁷⁴

The third major development with regard to CAW in World War II involved the use of self-propelled artillery. This was a further refinement of a capability first introduced in World War I. The earliest World War I British tanks were of two types, those that carried up to six machine guns only (females) and those that carried a combination of two 57mm artillery cannons and up to four machine guns (males). The males, while not normally referred to as self-propelled artillery carriers, were just that, providing artillery support at close range for advancing infantry. By the end of World War I, several countries had developed basic self-propelled artillery systems.

In World War II, all major powers employed self-propelled artillery systems. The caliber used on these vehicles typically ranged from 75mm to 200mm. Mounting an artillery piece to a tracked vehicle provided not only armor protection for the crew, but also enabled artillery forces to better keep up with, and provide indirect fire support to, mechanized units. In addition, ground based artillery systems were able to respond immediately to requests for indirect fire, even in the poorest weather – weather that would normally ground an airplane. Just as World War I saw the establishment of procedures enabling the close coordination of infantry with artillery, in World War II armies worked to effectively integrate tank forces with self-propelled artillery forces.

The next major CAW development in World War II involved the use of flying forward artillery observers. Employing light observation aircraft, they provided artillery observation and adjustment from an aerial observation point, or Air OP. As mentioned in the section on World War I, the best location from which to observe and adjust indirect fire is from the air. Both British and American artillery units employed small, light observation aircraft during World War II to observe and adjust artillery. Although pilots occasionally flew very near the front lines, they normally flew above friendly artillery units. They tried to never fly directly over enemy forces, and attempted to stay well out of range of enemy weapon systems.

Pioneered by the British Royal Army in the late 1930s, the practice was adopted by the U.S. Army in 1942.⁷⁵ The most famous U.S. aircraft employed for this purpose during the war was the small, single engine L4 Grasshopper. “Grasshopper” was a nickname the plane acquired in 1941, based on its “ability to hop from field to field.”⁷⁶ The Grasshopper was known as “the scourge of the German army,” and “it could bring

greater destructive power to bear on a selected target than any other single aircraft in the Second World War...[since it] could call in the artillery barrage of an entire army corps, sending the enemy scrambling within minutes.”⁷⁷ This system of aerial observation and adjustment was a tremendous success during World War II, as it more closely integrated artillery with infantry and armored forces.

Another advancement to CAW during World War II involved the establishment of organizations and procedures for conducting effective Close Air Support (CAS). Close Air Support is defined by Joint Publication 3-09.3., *Joint Tactics, Techniques, and Procedures for Close Air Support (CAS)*, as “air action by fixed- and rotary-wing aircraft against hostile targets that are in close proximity to friendly forces and that require detailed integration of each air mission with the fire and movement of those forces.”⁷⁸ Several critical developments during world War II advanced the practice of CAS for ground forces.

The first, and most obvious, aspect of World War II CAS capabilities is that in the late 1930s various militaries began to order aircraft specifically designed to attack ground targets. This trend ultimately resulted in several excellent ground attack aircraft being produced, aircraft such as the German JU-87 Stuka dive bomber, the British Hawker Typhoon, and the Russian IL-2 Sturmovik. All were classic examples of excellent ground attack aircraft.

Secondly, on the Allied side, the publication of the British Royal Army’s Wann-Woodall Report in August, 1940, served as the first real theory on how best to organize one’s forces in order to provide responsive CAS to ground forces. This report was the Royal Army’s attempt to create an effective and efficient system for the control of ground

attack aircraft. In the report, Lieutenant General Sir John Woodall reasoned “there were two...[air] battles to be fought....One was to shield the army from enemy air attack...The other was to bring the awe-inspiring weight of airborne firepower to bear on the battlefield itself, closely co-ordinated with the Army’s ground operations.”⁷⁹

Additionally, the report recommended the establishment of a theater level joint command post staffed by both army and air officers, air liaison officers to be placed at each division and brigade, and the creation of a communications network to link them all together.

This system was first employed by British forces in the North African campaign, and it allowed, for the first time, air officers at brigade level to contact directly the command center and request close air support.

The third important change to CAS procedures, again on the Allied side, took place in response to the American disaster of the North African Battle of Kasserine Pass in February, 1942. As explained by military writer Paul Johnston in an article titled "The Question of British Influence on U.S. Tactical Air Power in World War II":

At the time, and in many arguments since, this defeat was blamed in large part upon poor employment of the available tactical air power, which had been decentralized. Shortly after Kasserine, there was a reorganization of the Air Forces in the theater, which had the effect of bringing the U.S. tactical air effort under the wing of the veteran British commander of the Western Desert Air Force, Air Marshal Sir Arthur Coningham.⁸⁰

The defeat at Kasserine ultimately improved CAS procedures by forcing the Allies to centralize control of tactical airpower under one theater level air headquarters. There were certainly other improvements to CAS procedures during World War II, but none as significant as the production of aircraft specifically designed to attack ground targets, the British Royal Army’s Wann-Woodall Report, which established many of the basic CAS

procedures still in use today, and the lesson of centralizing tactical ground attack aircraft learned in response to the American defeat at Kasserine Pass.

The next major development in CAW during World War II has to do with unit organization. During the war, due in part to success of German blitzkrieg tactics, all major militaries created combined arms units. Armies reorganized this way so they could better conduct combined arms operations. American armored (tank) divisions reorganized to include organic infantry, reconnaissance, artillery, antitank, air defense, and engineer forces. Of note, though, is that no U.S. infantry divisions during the war possessed their own organic armor; all were supported by independent tank battalions. Aviation was another exception to the rule, as armies tended not to assign aviation assets (other than artillery forward observer aircraft) to ground combat units. Aviation units were normally kept together as part of a larger air force.

The use of rockets was another important development with regards to CAW in World War II. While rockets had been employed to a limited degree in prior wars, World War II was the first conflict that saw widespread use of rockets. Rockets came in various forms, to include handheld antitank weapons like the U.S. bazooka, which fired a 2.36 inch (later a 3.5 inch) High Explosive Anti-Tank (HEAT) round, or the German Panzerschreck, which fired an 88mm shaped-charge warhead. Large salvos of ship-to-shore rockets were even fired from Allied ships to prep the beaches before the June, 1944, D-Day amphibious landings in France. Yet another type was the surface-to-surface rocket. One of the most well known types was the German towed, six-barreled Nebelwerfer, nicknamed the “Screaming Mimi” by Allied troops, which fired a 75 pound, 150mm rocket over 6.5 kilometers.⁸¹ An even more devastating surface-to-

surface rocket system than the Nebelwerfer was the Soviet BM-13, a truck-mounted, multiple rocket launcher, which could salvo fire up to 48 Katyusha rockets.⁸² The system fired a 132mm rocket, with a range of 8.5 kilometers.⁸³ Even though both the Nebelwerfer and BM-13 systems were less accurate than traditional artillery, they were ideal for conducting saturation bombing of large areas. In fact, so important was the use of surface-to-surface rockets on the Eastern Front that Red Army rocket barrages are believed by some to be the decisive factor leading to the defeat of German Army Group B at Stalingrad in 1943.⁸⁴

Rockets were even fired from the tops of tanks and from aircraft. Albeit late in the war, small numbers of U.S. M4 Sherman tanks were issued the T34 Calliope tank mounted rocket launcher system, which fired sixty 105mm (4.5 inch) rockets from launch rails atop the turret. The system had a range of over four kilometers.⁸⁵ Rockets were also fired from ground attack aircraft during the war, and proved especially devastating when fired against tanks, as they tended to impact lightly armored areas of the vehicle, such as the top of the turret or engine compartment.

There are several obvious advantages to the adoption of the use of rockets in combined arms operations illustrated in World War II. The first advantage is the ability to target enemy forces at greater ranges than artillery. The second advantage is the ability to target enemy forces across large areas of terrain simultaneously through the use of rocket barrages. The third advantage is one of timing. If timing is critical, or if available time is limited, rockets can target enemy forces very quickly. Whereas artillery would take hours or days to attack enemy forces across a 20 kilometer square area, the same area can be attacked by salvos of thousands of rockets in only minutes.

Some may argue that the greatest reasons supporting the use of rockets are that they increase both a unit's firepower and its lethality. However, aside from this, there also exists the notion that rockets are simply just a natural technological extension of indirect fire. Though rockets lacked accuracy in World War II, since that time their accuracy has been increased dramatically. As such, rockets can now be seen as a third – and equal in importance – component of indirect fire, along with mortars and artillery. All three (mortars, artillery, rockets) have their own unique strengths and weaknesses. Also, rockets, and their modern day successors, missiles, cannot replace artillery, but can augment artillery.

The final major combined arms development in World War II was the airborne operation. The Soviet Union conducted the first combat airborne operation in 1939, as part of its initial invasion of Finland. Thereafter, they only conducted a handful of small operations, and never any large airborne operations. The Germans conducted successful airborne operations in Norway and Denmark in April, 1940, seizing key installations ahead of the German invasions of the countries with approximately one battalion's worth of paratroopers. One month later, in May, 1940, they dropped 4,000 paratroopers into Holland to take control of key strategic points (to include airfields) ahead of attacking German divisions. These operations proved extremely successful, as all of the airborne units were able to maintain control of their objectives until German forces arrived overland.⁸⁶ However, the last major German airborne operation took place only one year later, as part of the May, 1941, invasion of the Mediterranean island of Crete. While the Germans were successful in taking the island, they suffered 3,000 to 4,000 men killed, most of which were paratroopers. After this, due to the high losses, the Germans lost

interest in conducting large airborne operations. They carried out future airborne operations, but none larger than battalion size.⁸⁷ After the successful Crete operation was concluded, Adolf Hitler reportedly told General Kurt Student, the leader of the airborne forces at Crete, "Of course, General, you know that after Crete we shall never do another Airborne operation. The parachute arm is one that relies entirely on surprise. That surprise factor has now exhausted itself...the day of the Paratroops is over".⁸⁸

The Americans, on the other hand, conducted numerous large airborne operations throughout the war. By war's end, the U.S. had conducted 14 large airborne operations and dozens of smaller ones.⁸⁹ Some well known larger airborne drops were part of operations in Sicily in 1943, Normandy in 1944, and as part of Operation Market Garden (the Rhine) in 1945. Other, smaller, airborne operations took place in North Africa in 1942, New Guinea and Burma in 1943, and Corregidor in 1945.

Airborne operations, by their very nature, are combined arms operations, since their success is highly dependent on their ability to be supported by other branches of the military for fire support and logistics. Close cooperation with other arms is necessary if an airborne operation is to be successful. When successful, these operations can leap frog forces ahead great distances to secure key military objectives. Airborne operations are largely dependent on the elements of operational security (secrecy) and surprise. The primary danger inherent in using airborne forces is that they cannot survive very long without resupply, either by ground or air. They must either be resupplied within two to three days, or else link up with other friendly forces. Additionally, airborne units depend heavily upon close air support for indirect fire, since they can only carry with them initially a very limited quantity of mortar and artillery ammunition.

Korean War (1950-1953)

In many ways, the Korean War was an extension of World War II, in that only five years had elapsed between the end of the second world war and the start of the Korean conflict. Aside from developments in jet technology, armies generally fought in Korea with the same type of organizations, technology, and equipment they possessed in 1945; they went to war in Korea with what they had. The U.S. Army was downsizing, and a debate was beginning to take shape in the Department of Defense about the future role of the Army in the nuclear age.

Yet, change never stops, and the conflict did see several key combined arms developments, the first of which was the introduction of helicopters by the U.S. Marine Corps. This was the beginning of vertical lift aviation and air mobility. While the Vietnam War would later see helicopters used in an air assault role, the Marines used helicopters in Korea primarily as air ambulances and for liaison, as well as for limited troop and logistics movement.⁹⁰

Following World War II, the Marine Corps considered whether or not amphibious operations were still valid in the age of atomic weapons. Marine officials ultimately concluded that the amphibious mission was indeed still valid, but that it could no longer be conducted as it had been in World War II, with large numbers of ships vulnerably concentrating close to shore.⁹¹ With future enemy armies potentially having nuclear weapons, amphibious operations would now need to be conducted with greater speed and surprise, and from naval ships dispersed over a wider area than during World War II amphibious landings.⁹² One Marine Corps historian explained it best:

What the new concept envisaged, in brief, was an assault landing without concern for reefs, beaches, beach defenses, and surf; a landing from the air but free of the

inflexibility, tactical disorder, and disorganization of parachute operations; an airborne attack independent of airfields and airheads; a landing force that could be launched from ships widely dispersed and under way miles off shore.⁹³

The helicopter was the ideal machine to bring this idea to fruition for the Marine Corps.

Later, in Korea, Marines found that helicopters added combat capabilities to units widely dispersed and often fighting completely surrounded, aiding Marine infantry units in the accomplishment of their missions. In fact, during Chosin Reservoir operations in November and December of 1950, helicopters provided the only means available for isolated commands to communicate.⁹⁴ After several operations in which helicopters played a significant role, Lieutenant Colonel Keith McCutcheon, the commander of the only Marine helicopter squadron in Korea, wrote, “A military without helicopters in the future will be as obsolete as a cart without a horse. They will give to the military a new style of cavalry with the all important characteristics of mobility, speed, and dispersion.”⁹⁵

The second combined arms development in the Korean War was the large use of self-propelled antiaircraft machine guns in a ground fire support role against attacking enemy personnel. These weapons were devastating against Chinese human wave attacks, and illustrate the value of possessing weapons which have multi-uses and can accomplish multiple roles, as opposed to weapons systems which may have become too specialized. The use of these weapons in the Korean conflict also points out that precision fire will not be effective against all battlefield threats.

The primary weapon used in this method was the Quad 50. Organic to self-propelled antiaircraft units, Quad 50s were used effectively in an antiaircraft role in World War II. The Quad 50 consisted of four caliber .50 machine guns mounted on a

truck, half-track, or trailer. Still used in their traditional air defense mission during the Korean War, they were also employed in an infantry support role against enemy massed formations. Quad .50s took part in numerous U.S. engagements throughout the war. The employment of antiaircraft weapons in an infantry support role further highlights the need for close cooperation between infantry and other supporting arms, depending on the type of enemy tactics employed, the terrain, and any other relevant factors.

The final combined arms development of the Korean War was the widespread use of aerial resupply to logistically support ground units. Logistics facilitates the combined arms fight and without adequate supplies units cannot function. It could be said that the railroad and steam locomotive brought military logistics into the nineteenth century, and that motor vehicles brought logistics into the 20th century.⁹⁶ Now, in Korea, the Army began a new chapter in logistics, using aircraft to airdrop massive amounts of supplies such as winter clothing, fuel, water, food, and ammunition on an unprecedented scale to forward units so that they could continue to fight effectively.

In Korea, American units were regularly dispersed over large distances and isolated by restrictive mountainous terrain. Whether due to the enemy's "penchant for flanking operations"⁹⁷ or to terrain which facilitated infiltration by offering excellent concealment, U.S. units were at times completely surrounded by North Korean or Chinese forces. Though occasionally surrounded, only one large U.S. unit was ever completely destroyed as a fighting unit in the war, the 31st Regimental Combat Team (RCT 31) of the 7th Infantry Division.⁹⁸ This action took place at the Chosin (Changjin) Reservoir during late November and early December, 1950.

In his book, *Blitzkrieg to Desert Storm: The Evolution of Operational Warfare*, military historian and author Robert M. Citino argues, “no one in the U.S. military should be very happy with the Army’s overall performance in the Korean War.”⁹⁹ He goes on to say that “lacking the modern systems of supply, replacement, and administration” neither the North Koreans nor the Chinese were able to sustain their military operations in South Korea.¹⁰⁰ Accepting this as true, it may be said that U.S. logistics (Army and Marine Corps) were ultimately the deciding factor in the conflict.

In addition, Korea had very limited road networks, which meant it was often a difficult, and slow, process to get supplies to forward units. For example, units were sometimes situated on terrain miles away from the nearest road. The tactical situation, difficult terrain, and depth of the battlefield ultimately led to a fundamental change in the way units were resupplied, resulting in the widespread use of aerial resupply.

One of the primary aircraft types used to resupply U.S. forces in the conflict was the Fairchild C-119 Flying Boxcar, which served as part of the U.S. Air Force’s 314th Troop Carrier Group. This aircraft airdropped supplies to U.S. and United Nations forces throughout the war, but its greatest accomplishment was the December, 1950 mission to support the retreat of encircled regiments of the U.S. 1st Marine and 7th Army Divisions from the Chosin Reservoir area. Over the course of two days, C-119s airdropped fuel, ammunition, and rations, as well as eight 2,500-pound sections of an M2 treadway bridge, allowing Marine engineers to successfully span a deep gorge south of Koto-ri which blocked their only escape route. This action by the 314th Troop Carrier Group allowed the Marine and Army units to escape Chinese encirclement by vehicle in the bitter cold, rather than having to go on foot, and to save the majority of their equipment

as well.¹⁰¹ It is also an excellent illustration of how aerial resupply plays an important role in supporting ground unit combined arms operations. Warfare continues to increase in speed, from the foot mobile units of World War I, to the faster mechanized units of World War II, to today's even faster helicopter mobile units. Only an aerial resupply based supply distribution system can act with the speed required to support today's fast paced combined arms organizations.

Vietnam War (1959-1975)

The Vietnam War may have been an operational level failure in the larger struggle against the rise of communism in Asia, but it did serve to dramatically further combined arms warfare in the U.S. Army. One problem, however, is that by labeling the war a failure at the tactical level, the U.S. Army may be preventing itself from taking a critical look at "what went right" during the war. Much did go right with how the Army conducted the war, given the politically mandated constraints. In particular, airmobile tactics, the integration of the helicopter gunship, and the armored cavalry regiment (ACR), are all items which radically improved the Army's combined arms capabilities.

During the Vietnam conflict, based on its experiments with helicopters in the early 1960s, the Army demonstrated a new concept called air envelopment. Air envelopment involved either: 1) the movement by air of friendly ground forces to positions from which they can completely encircle an enemy ground force, or 2) the movement by air of friendly ground forces to positions from which they can attack an enemy ground force from multiple directions near simultaneously. In order to conduct air envelopment, the U.S. Army developed the tactic of conducting multiple battalion size air assaults, which allowed infantry and artillery units to be moved into position quickly.

The helicopter's speed, as well as its ability to fly either over or around ground obstacles, facilitates this type of tactic, creating tremendous advantage to a helicopter equipped military force.

In 1963, the Army established the 11th Air Assault Division, its first unit capable of rapid air envelopment. This unit was later redesignated the 1st Air Cavalry Division (Airmobile), and in 1965 deployed the unit to Vietnam. The 1st Air Cavalry Division (1st CAV) had an organic aviation brigade, consisting of light reconnaissance, medium lift, and heavy lift helicopters, as well as three infantry brigades. In addition, within its Division Artillery (DIVARTY) it had three organic towed 105mm artillery battalions and one Aerial Artillery Battalion of rocket firing helicopters. The 1st CAV performed extremely very well in Vietnam, conducting multiple high profile air assault operations against North Vietnamese forces. The air assault tactic formed the mainstay of their operations. They also developed the tactic of airlifting 105mm artillery units onto jungle mountaintops and from there establishing fire bases from which to support infantry search and destroy operations designed to disrupt enemy operations.

In general, air envelopment is a sound tactical concept. However, the North Vietnamese were somewhat able to counter this tactic through the use of human wave style attacks, because ground infantry units within air mobile divisions are still simply light infantry forces, and are highly dependent upon either their organic helicopter gunships or Air Force fixed wing aircraft for CAS. In addition, they must rely heavily on mortars or artillery for ground based indirect fires to beat back large enemy assaults. Other vulnerabilities of air mobile units include the difficulty of flying helicopters in conditions of limited visibility (poor weather, extreme darkness) and the risk of losing

aircraft when flying in areas with high concentrations of antiaircraft guns or surface to air missiles.¹⁰²

Central to air assault operations is the need for close cooperation between ground units and helicopter units to coordinate the many details inherent in an air assault. Due to the amount of planning and coordination required, air assaults are, by their very nature, combined arms operations. Therefore, the pre-air assault planning and coordination is much more efficient in units such as 1st CAV which have their own organic helicopter units, since all units within the division may be on the same exact standard for how to plan and coordinate for an air assault.¹⁰³ Invariably, ground units conducting air assaults in conjunction with aviation units with which they do not have habitual command relationships will find coordination more difficult.

Following the success of 1st CAV in Vietnam, the Army established a second air mobile division. The *History of the 101st Airborne Division* website explains:

...the 101st Airborne Division changed its name to the 101st Air Cavalry Division on 1 July 1968. A year later, on 29 August 1969, the Screaming Eagles became the 101st Airborne Division (Air Mobile), becoming the Army's second air mobile division, in recognition of the transition from parachutes to helicopters...The 101st underwent significant identity changes during 1974. On 1 February...Major General Sidney B. Berry, Commanding General of the 101st, authorized the wearing of an airmobile badge. When the airmobile designation was dropped on 4 October that same year, the Division added the Air Assault designation.¹⁰⁴

Like the 1st CAV, the 101st Air Assault Division also conducted air assault operations in Vietnam. One brigade of the 101st Division began operating in Vietnam in mid 1965, and the remainder of the division deployed to Vietnam in 1967. The 101st Division remained in Vietnam through early 1972, and was the last U.S. division to depart Vietnam.¹⁰⁵

Today, the U.S. Army has numerous aviation (helicopter) brigades, but the high cost of

purchasing and maintaining helicopters has prevented it from establishing more airmobile capable divisions. Today, the 101st Air Assault Division is the Army's only dedicated airmobile division.

The second major combined arms related development during the Vietnam War was the introduction of the helicopter gunship. Units conducting air assaults were found to need a dedicated gunship, to provide close-in suppressive fire for air assaulting forces when inserting and extracting from Landing Zones (LZs). Initially, during 1962-1965, caliber .30 machine guns and 2.75 inch rocket pods were mounted on Bell UH-1 Iroquois helicopters (unofficially named the Huey), so that they could provide air escort to air assaulting units, as well as suppressive fire at LZs. Later, beginning in 1967, the U.S. Army began fielding its first true helicopter gunship, the Bell AH-1 HueyCobra, with the SeaCobra variant being fielded by the Marine Corps in 1968.¹⁰⁶

The AH-1 HueyCobra was armed with a 20mm cannon and 2.75 inch (70mm) unguided rockets, and it proved to be an extremely effective close-in weapon during the conflict. Of note, the Cobra was able to get into locations that armored vehicles could not, such as in dense jungle areas far from any roads. In addition to its helicopter escort mission, the Cobra also saw action as a direct fire weapon in support of regular infantry units. It proved to be a powerful tool against enemy bunker complexes. Often, enemy bunkers were so well camouflaged in thick jungle that U.S. infantrymen did not see these interlocking bunkers until they were well within the kill-zone of the enemy's larger bunker complex. In their article, "Lessons from Vietnam: Combined Arms Assault against Prepared Defences," military historians Robert Hall and Andrew Ross discuss

how the Cobra gunship proved to be one of the best support weapons for infantry units caught in the grip of dangerous enemy bunker systems:

...helicopter gunship support possessed the capacity to provide intimate fire-support capable of suppressing enemy fire from individual bunkers, and to within 10 to 15 metres forward of friendly forces...The gunships were even more useful [than indirect fire] because they could engage individual bunkers. Having been pinned down by enemy fire, many platoons were rescued from dangerous positions by helicopter gunships firing directly at the offending bunkers.¹⁰⁷

Similar to the manner in which the World War I tank was able to bring the machine gun across No-Man's Land in support of attacking infantry, the Vietnam era helicopter gunship brought close-in, dominant suppressive fire to remote locations, across any type of terrain, in support of infantry forces. Often called the "attack helicopter" today, the integration of helicopter gunships into U.S. operations during the Vietnam War was a major milestone in combined arms history.

The Vietnam War also demonstrated the extreme versatility of the Armored Cavalry Regiment (ACR). At the time of the Vietnam War the Army had five ACRs; however, only the 11th ACR served in Vietnam. It deployed to Vietnam in September, 1966, where it conducted operations in both South Vietnam and Cambodia. The unit spent five and a half years in country, and took part in 14 different major battles.

Traditionally, the role of cavalry organizations has been reconnaissance and security. Similarly, ACRs were designed to be self-contained, combined arms forces, organized to conduct reconnaissance, surveillance, and security missions for an Army corps over a wide area and at great distances away from other units. An ACR was normally comprised of three ground cavalry squadrons, an air cavalry squadron, and a support squadron. Each ground cavalry squadron was designed to be a highly mobile, armor-protected force, and traditionally included three ground armored cavalry troops, a

tank company, and a self-propelled howitzer battery. In the case of the 11th ACR, the ground cavalry troops were equipped with M551 Sheridan tanks and M113 armored personnel carriers. At full strength, the 11th ACR was allotted 3,349 personnel, 48 helicopters, and 132 tanks.¹⁰⁸

Before arriving in Vietnam the 11th ACR began modifying its M113s, augmenting the vehicle's single caliber .50 machine gun with the addition of two caliber .30 machine guns. Shields were also added for the protection of the machine gunners. The result was the Armored Cavalry Assault Vehicle (ACAV), which was so successful in battle that it "prompted the army to convert personnel carriers in other units in a similar fashion."¹⁰⁹ Used in conjunction with organic Sheridan tanks, M109 155mm self-propelled artillery, and Huey helicopters (both lift and armed gunship versions), the ACAVs proved to be very effective in counter-guerrilla operations conducted by the unit.

The 11th ACR was a very mobile combined arms force. The unit's area of operations included several provinces near Saigon. It demonstrated its outstanding mobility in early 1968, when Vietcong forces attacked Saigon as part of the Tet Offensive. Elements of the 11th ACR moved over 100 kilometers in only eight hours to come to the defense of the city, its units fighting street by street to defeat the Vietcong.¹¹⁰

In July, 1968, Colonel George S. Patton, son of famed World War II Lieutenant General George Patton, took command of the unit. He launched aggressive search and destroy missions in the area between the Cambodian border and Saigon, in hopes of disrupting enemy supply routes leading into the South Vietnamese capital. He also encouraged subordinate leaders to maneuver their armored vehicles off roads and into the jungle. The unit's new all-arms, search and destroy tactics proved very successful,

preventing enemy forces from moving freely in the area. In addition, it also had the effect of driving Vietcong and North Vietnamese forces to establish sanctuary inside neutral Cambodia.¹¹¹ This led to the May, 1970, operation across the Cambodian border by the 11th ACR to deny enemy forces this safe haven. The result was the capture and destruction of tons of Vietcong and North Vietnamese weapons and supplies. Overall, the operation left the enemy unable to conduct large offensive operations for at least the next two years. The Cambodian incursion by the 11th ACR was the last large U.S. ground operation of the war.

The 11th ACR's combined arms organizational structure and its tremendous mobility made it one of the most capable military units during the Vietnam War. With its outstanding mobility, it could move soldiers under armor protection, or by helicopter if speed was required. It could conduct limited air assault operations, and its organic helicopters allowed it to conduct reconnaissance over wide areas. In addition, the unit's aggressive search and destroy tactics honed its ability to locate, close with, and defeat the enemy.

Gulf War (1990-1991)

Although short, with the ground phase lasting only four days before a Coalition ceasefire was ordered, several important combined arms concepts were validated during the Gulf War. One is that the U.S. Army's National Training Center (NTC) had, over the course of the previous decade, done an excellent job honing combined arms warfighting skills in a desert environment, making Army units much more proficient at combined arms warfare than their Iraqi counterparts. Another point is that the U.S. Army went to war with an excellent tactical warfighting doctrine, called AirLand Battle, which resulted

in Iraqi forces being encircled and completely annihilated. Finally, the close integration of radical new weapons systems, such as the M1 tank, Patriot missile, and Multiple Launch Rocket System (MLRS), created a balanced and extremely lethal combined arms force far more capable than that of Iraq's.

Activated in October, 1980, the NTC, situated at Fort Irwin, California, is one of four current CTCs within the Army responsible for training unit leaders on the conduct of combined arms operations. Located in the Mojave Desert, it is the only CTC to train units in a desert environment, and it was this desert training that prepared Army units on the intricacies of the all-arms fight in the inhospitable desert wind, dust, and heat similar to what they would find in Iraq during the Gulf War. Monthly training rotations were used to train battalions and brigades on how to conduct combined arms operations.

While having high technology weaponry and sound tactical doctrine are certainly important, unless armies conduct large scale combined arms training on a regular basis they will quickly lose proficiency in how to plan and synchronize tactical operations. Training centers such as the NTC were invaluable at maintaining these skills. In his book, *Blitzkrieg to Desert Storm: The Evolution of Operational Warfare*, military historian and author Robert M. Citino notes there is no substitute for conducting large-scale training:

From the Wehrmacht's first test of a full panzer division in the German Fall Maneuvers of 1937 to the repeated honing of NATO's transport and war-fighting capabilities in REFORGER to one of the toughest training regimens ever established, at the Fort Irwin NTC, the maneuver ground has been, and will always be, crucial to the development of the operational art. Unfortunately, large-scale operational maneuvers have typically been among the first casualties of tight budgets, in Germany in the 1920s and the United States more recently. History would indicate that it is a bad place to save money.¹¹²

Maintaining proficiency in the complicated skills of combined arms requires continual training in as realistic a scenario as possible. The importance to units of conducting regular large-scale, intense, rigorous, and realistic training cannot be overstated. Units need the physical space that only a large maneuver training area offers to train aspects such as mechanized unit maneuver and logistics sustainment. The NTC provided this training area for Army units and their leaders prior to their participation in the Gulf War. This training in combined arms operations at Army CTCs was another contributing reason why Army forces did so well in operations against Iraqi forces in the Gulf War.

In many ways, the success of the U.S. Army in the Gulf War was also a validation of the Army's premiere combined arms focused doctrine, AirLand Battle. Initially set out in the 1982 Field Manual (FM) 100-5, *Operations*, then later refined in the 1986 version of FM 100-5, AirLand Battle created a new three part battlefield framework which encouraged divisions and corps to conduct synchronized operations simultaneously throughout their Deep, Close, and Rear areas. A much more offensively oriented doctrine than its 1970s era predecessor Active Defense, AirLand Battle outlined how a quick and decisive victory could best be achieved "by conducting simultaneous offensive operations over the full breadth and depth of the battlefield."¹¹³ It also emphasized encirclement and annihilation of the enemy, and stressed the importance of seizing the initiative early in a conflict and then maintaining it through attacking with aggressive, offensive maneuver, causing the enemy to become overwhelmed through having to defend everywhere at once. Even second echelon and reserve forces in the enemy's rear area would be targeted. Attacks conducted throughout the depth of the

battlefield would defeat the enemy's will to fight and his ability to organize his formations in depth.¹¹⁴

AirLand Battle doctrine also had definite roots in German blitzkrieg tactics. Numerous references to World War II tactical blitzkrieg operations can be found throughout FM 100-5. Robert Citino stresses this historical linkage:

In fact, it is not an exaggeration to say that...Airland Battle was nothing less than a call for U.S. ground forces, working in close cooperation with air power, to re-create the German blitzkrieg. Even if forced temporarily onto the defense, U.S. forces would launch devastating and unexpected blows against the enemy's front lines, penetrating and overrunning his assembly areas, while long-range air, artillery, and missile strikes against follow-on and reserve forces turned his supposedly secure rear area into an inferno.¹¹⁵

As Citino clearly points out, in some respects AirLand Battle was nothing less than the requirement for the U.S. Army to finally master the type of mechanized warfare pioneered by the Germans in World War II. The difference was that the U.S. would be going against a technologically inferior adversary; a much different scenario than that in which U.S. forces found themselves in World War II, fighting against the German Wehrmacht.

To many, the success of U.S. Army forces in the Gulf War seemed to be the full expression of AirLand Battle doctrine in action. Aircraft targeted Iraqi forces throughout the depth of the battlefield for a full 38 days before the ground invasion began. When the ground attack finally did begin, it started with massive volleys of U.S. rockets into Iraqi formations throughout the breadth and depth of the battlefield, and was then followed by fast moving, aggressive, ground maneuver to close with and destroy remaining Iraqi forces. Of course, the fight really only took place in Coalition Deep and Close areas, not

the Coalition Rear area, since there were no Iraqi airborne or special operations forces operating in the Coalition Rear.

Others, it should be pointed out, did not interpret the Gulf War as a validation of the efficacy of AirLand Battle doctrine. Rather, they viewed Coalition air power as the real victor of the war, and noted that the massive aerial bombing campaign was the decisive factor in the Coalition's victory. In their view, the success of the Gulf War can be seen as a validation of the doctrine of aerial bombardment.¹¹⁶ However, there exists a real danger in minimizing the tremendous impact of ground maneuver in general and AirLand Battle in particular during the war. In fact, following the conflict one captured Iraqi battalion commander allegedly stated, "On 17 January [1991], I started with 39 tanks. After 38 days of aerial attacks, I had 32 [tanks], but in less than 20 minutes with M1A1 [tanks], I had zero."¹¹⁷ Only by utilizing forces on the ground can we be certain that an enemy force is destroyed.

The third major development in the Gulf War had to do with the close integration of several radical new weapons systems. This was the first major conflict in which these systems were tested under fire. The list of new, previously untested weapons systems included the M1 tank, the M2 Bradley Infantry Fighting Vehicle, the AH-64 Apache attack helicopter, the Pioneer Unmanned Aerial Vehicle (UAV), and MLRS. All of these systems performed remarkably well. Some, however, did experience minor teething problems, such as M1 engine air filters and AH-64 rotor blades which were negatively affected by blown sand from by heavy sand storms.¹¹⁸ Operating together, these systems helped to create an extremely effective combined arms force, one which quickly and efficiently destroyed Iraqi forces across the full breadth and depth of the battlefield.

Iraq War (2003-Present)

The Iraq War has tested the U.S. Army in many ways. After the conventional portion of the war against the Iraqi military which lasted only six weeks, the threat then transformed into an Al-Qaeda supported insurgency. Throughout the conflict the Army has been able to continuously transform and refine its doctrine, unit organization, and equipment. Yet, to date there have been only two truly significant combined arms related developments.

The Army wide use of Tactical Satellite (TACSAT) radios is the first significant combined arms development to come out of the Iraq War. During the 1990-1991 Gulf War Army units used satellites primarily for GPS navigation, and only a handful of high level headquarters had TACSAT radios. The significance of these radios is that they have a much greater distance capability than tactical FM radios, essentially allowing units to communicate to and from anywhere in the world. Modern FM radios typically have ranges in the 20-30 kilometer range, depending upon the terrain. In urban environments that range can be reduced significantly, oftentimes to less than one kilometer.

Tactical satellite radios allowed units in the Iraq War to communicate at distances beyond FM radio range. Yet, unlike FM radios, TACSAT radios do not currently allow true on-the-move communications. Units must be stationary and then setup a small dish-type TACSAT antenna to make the system work. The antenna must to have direct line-of-sight to a designated communications satellite in the sky. The best reception will be found by not placing the antenna inside a vehicle, but rather setting it up either on top of one's vehicle or on the ground. A true on-the-move capable TACSAT radio is technologically possible, but only once a ruggedized TACSAT antenna has been created

by either the U.S. government or private industry. The antenna needs to be ruggedized, so it can remain stable and unaffected by uneven, bumpy road surfaces.

The other major improvement which came out of the Iraq War was the ROVER Video Terminal, which has dramatically improved air-ground coordination for CAS. Officially designated the Remotely Operated Video Enhanced Receiver, a ROVER Video Terminal is simply a TACSAT antenna, a ruggedized laptop, and special software on the laptop which enables ground based Air Force forward air controllers, now called Joint Tactical Air Controllers (JTACs), to better communicate with the pilots providing CAS for a ground unit.

Prior to the JTAC community's adoption of ROVER, JTACs could not be certain that pilots were planning to drop their bombs on the correct target. Pre-ROVER, JTACs had the difficult job of trying to describe a particular target to a pilot while the pilot was also flying his aircraft. This can sometimes cause the pilot to become overwhelmed and attack the wrong target. Now, the JTAC sees the exact same image on his ROVER Video Terminal the pilot sees in his cockpit. If the image is of the wrong target, then the JTAC can direct the pilot to the correct target. The ROVER system improves communication between the JTAC and pilot, ensuring they both are seeing the same target. U.S. Air Force Staff Sergeant Justin Cry, a JTAC with combat experience in Iraq, explains the value of the ROVER system when he states, "I can circle an area on my screen, drawing arrows for emphasis, and what I'm drawing appears on the pilots' screens as well."¹¹⁹

While there has been no definitive study on the subject, one can expect that the ROVER Video Terminal has significantly reduced CAS-induced fratricide and collateral damage. This system increases the ground commander's situational awareness, his

confidence that CAS aircraft will strike the correct target, and the overall level of air-ground coordination on the battlefield. In short, the ROVER Video Terminal has revolutionized how the U.S. military conducts CAS.

¹Michael Evans, "General Monash's Orchestra: Reaffirming Combined Arms Warfare," In *Land Warfare Studies Centre (LWSC) Working Papers No. 122, From Breitenfeld to Baghdad: Perspectives on Combined Arms Warfare* - pp 1-26. Edited by Michael Evans and Alan Ryan, Duntroon, AUS: Land Warfare Studies Centre, July, 2003, 1.

²Stephen Biddle, "The Past as Prologue: Assessing Theories of Future War", *Security Studies*, Autumn 1998, vol. 8, no. 1, 16.

³Michael Evans, "General Monash's Orchestra," 9.

⁴*Ibid.*, 10.

⁵*Ibid.*

⁶David Chandler, *Napoleon*, London, UK: Weidenfeld & Nicholson, 1973, 202.

⁷House, *Toward Combined Arms Warfare*, 32-33.

⁸*Ibid.*, 13.

⁹Martin van Creveld, *The Changing Face of War: Lessons of Combat From the Marne to Iraq*, New York, NY: Presidio Press, 2006, 50-51.

¹⁰House, *Toward Combined Arms Warfare*, 27.

¹¹Martin Gilbert, *The First World War: A Complete History*, New York, NY: Henry Holt and Company, 1994, 144.

¹²Herbert Jager, *German Artillery of World War One*, Wiltshire, UK: The Crowood Press Ltd, 2001, 197.

¹³Gilbert, *The First World War*, 145.

¹⁴*Ibid.*

¹⁵The Great War: The Complete History of World War I, Video documentary, Narrated by Patrick Boniface, KOCH Entertainment LP, Port Washington, NY, 2006, Disc 1.

- ¹⁶House, *Toward Combined Arms Warfare*, 34.
- ¹⁷*Ibid.*
- ¹⁸*Ibid.*, 36.
- ¹⁹*Ibid.*, 34.
- ²⁰*Ibid.*
- ²¹John Keegan, *An Illustrated History of The First World War*, New York, NY: Alfred A. Knopf, 2001, 352.
- ²²Evans, "General Monash's Orchestra," 13.
- ²³John Glanfield, *The Devil's Chariots: The Birth & Secret Battles of the First Tanks*, Gloucestershire, UK: Sutton Publishing Limited, 2001, 153.
- ²⁴*Ibid.*
- ²⁵Keegan, *An Illustrated History of The First World War*, 280.
- ²⁶Glanfield, *The Devil's Chariots*, 157.
- ²⁷Keegan, *An Illustrated History of The First World War*, 277.
- ²⁸Medium A or Whippet (tank), Encyclopædia Britannica Online, Online at <<http://www.britannica.com/eb/topic-372738/Medium-A>>, Copyright 2007 Encyclopædia Britannica, Inc. (accessed March 5, 2008).
- ²⁹van Creveld, *The Changing Face of War*, 74.
- ³⁰*Ibid.*
- ³¹House, *Toward Combined Arms Warfare*, 179.
- ³²WW1 Anti-Tank Rifles, Anti Tank Rifle Collecting and History, Online at <http://www.antitank.co.uk/ww1_anti-tank_rifles1.htm>, Copyright June 2007, (accessed March 5, 2008).
- ³³Keegan, *An Illustrated History of The First World War*, 278.
- ³⁴*Ibid.*, 379.
- ³⁵*Ibid.*

³⁶Shelford Bidwell and Dominick Graham, *Fire-Power: The British Army Weapons & Theories of War 1904-1945*, S. Yorkshire, UK: Pen & Sword Book Limited, 2004, 91-92.

³⁷*Ibid.*, 91.

³⁸Keegan, *An Illustrated History of The First World War*, 278.

³⁹van Creveld, *The Changing Face of War*, 52.

⁴⁰Keegan, *An Illustrated History of The First World War*, 210-211.

⁴¹*Ibid.*, 69, 71.

⁴²van Creveld, *The Changing Face of War*, 52.

⁴³*Ibid.*

⁴⁴House, *Toward Combined Arms Warfare*, 16.

⁴⁵van Creveld, *The Changing Face of War*, 52.

⁴⁶House, *Toward Combined Arms Warfare*, 20.

⁴⁷Bernard and Fawn M. Brodie, *From Crossbow to H-Bomb: The Evolution of the Weapons and Tactics of Warfare*, Bloomington & Indianapolis, Indiana: Indiana University Press, 1973, 193.

⁴⁸House, *Toward Combined Arms Warfare*, 20.

⁴⁹Bidwell and Graham, *Fire-Power*, 141.

⁵⁰Mike Chappell, *The British Army in World War I (2): The Western Front 1916-1918*, Oxford, UK: Osprey Publishing, 2005, 12.

⁵¹*Ibid.*, 12-13.

⁵²Bidwell and Graham, *Fire-Power*, 53.

⁵³*Ibid.*, 72.

⁵⁴*Ibid.*, 75.

⁵⁵*Ibid.*, 72.

⁵⁶Keegan, *An Illustrated History of The First World War*, 336.

⁵⁷van Creveld, *The Changing Face of War*, 54.

⁵⁸Ibid., 55.

⁵⁹Ibid.

⁶⁰Ibid.

⁶¹Ibid.

⁶²Charles Messenger, *The Blitzkrieg Story*, New York, NY: Charles Scribner's Sons, 1976, 58.

⁶³Ferdinand O Miksche, *Attack: A Study of Blitzkrieg Tactics*, New York, NY: Random House, 1942, 10.

⁶⁴Christopher R. Gabel, *Seek, Strike, and Destroy: U.S. Army Tank Destroyer Doctrine in World War II*, Leavenworth Papers No. 12, U.S. Army Command and General Staff College, Fort Leavenworth, KS: USACGSC, September, 1985, 68.

⁶⁵Messenger, *The Blitzkrieg Story*, 102.

⁶⁶Gabel, *Seek, Strike, and Destroy*, 52.

⁶⁷Ibid., 19.

⁶⁸Ibid.

⁶⁹Ibid., 19-20.

⁷⁰Ibid., 25-26.

⁷¹Ibid., 56.

⁷²Ibid., 39.

⁷³Ibid., 33.

⁷⁴Ibid., 40-41.

⁷⁵Utility, Liaison, Observation Aircraft, Global Security.org website, Online at <<http://www.globalsecurity.org/military/systems/aircraft/utility.htm>> (accessed April 10, 2008).

⁷⁶Ibid.

⁷⁷Ibid.

⁷⁸U.S., Department of Defense, JP 3-09.3, *Joint Tactics, Techniques, and Procedures for Close Air Support (CAS)*, Washington, DC: Government Printing Office, September 2003, I-1.

⁷⁹Bidwell and Graham, *Fire-Power*, 264-265.

⁸⁰Paul Johnston, "The Question of British Influence on U.S. Tactical Air Power in World War II," *Air Power History*, Vol. 52 (Spring 2005), 17.

⁸¹Nebelwerfer, "Six-Barrel Rocket Weapon (The *Nebelwerfer 41*)" from the 1943 *Intelligence Bulletin*, Online at <<http://www.lonesentry.com/articles/nebelwerfer/index.html>>, Copyright 2003-2007, LoneSentry.com (accessed April 10, 2008).

⁸²BM-13 Katyusha Rocket, GlobalSecurity.org, Online at <<http://www.globalsecurity.org/military/world/russia/katyusha.htm>>, Copyright © 2000-2008 (accessed April 10, 2008).

⁸³BM-13 Launcher Specifications, GlobalSecurity.org, Online at <<http://www.globalsecurity.org/military/library/report/1987/MAF.htm>>, Copyright 2000-2008 (accessed April 10, 2008).

⁸⁴Brodie and Brodie, *From Crossbow to H-Bomb*, 228.

⁸⁵Robert J. Holt, "Rocket Tanks in the 752nd Tank Battalion," Online at <<http://www.752ndtank.com/RocketTanks.html>>, Copyright 2003 - 2007 Robert J. Holt (accessed April 10, 2008).

⁸⁶Airborne Operations in World War II, GlobalSecurity.org, Online at <<http://www.globalsecurity.org/military/ops/airborne1.htm>>, Copyright 2000-2008 (accessed April 12, 2008).

⁸⁷Ibid.

⁸⁸The Battle of Crete (World War 2), Explore Crete: The Travel Guide for the Real Crete, Online at <<http://www.explorecrete.com/preveli/battle-of-crete.html>>, Copyright 2008 (accessed April 12, 2008).

⁸⁹Airborne Operations in World War II (accessed April 12, 2008).

⁹⁰John R. Galvin, *Air Assault: The Development of Airmobile Warfare*, New York, NY: Hawthorn Books, Inc., 1969, 254-256.

⁹¹Terry C. Pierce, *Warfighting and Disruptive Technologies: Disguising Innovation*, New York, NY: Frank Cass, 2004, 72.

⁹²Ibid.

⁹³Robert D. Heinl, *Soldiers of the Sea: The United States Marine Corps, 1775-1962*, Annapolis, MD: United States Naval Institute Press, 1962, 513.

⁹⁴Pierce, *Warfighting and Disruptive Technologies*, 74.

⁹⁵*Ibid.*

⁹⁶Brodie and Brodie, *From Crossbow to H-Bomb*, 148, 173.

⁹⁷Robert M. Citino, *Blitzkrieg to Desert Storm: The Evolution of Operational Warfare*, Lawrence, KS: University Press of Kansas, 2004, 149.

⁹⁸*Ibid.*, 152.

⁹⁹*Ibid.*, 149.

¹⁰⁰*Ibid.*, 151.

¹⁰¹C-119 Flying Boxcar, GlobalSecurity.org, Online at <<http://www.globalsecurity.org/military/systems/aircraft/c-119.htm>>, Copyright 2000-2008 (accessed April 11, 2008).

¹⁰²House, *Toward Combined Arms Warfare*, 162.

¹⁰³*Ibid.*, 164.

¹⁰⁴History of the 101st Airborne Division, Online at <http://www.lzsally.com/sally2/archives/history_of_the_101st_airborne_di.htm> (accessed April 11, 2008).

¹⁰⁵*Ibid.*

¹⁰⁶Bell Model 209 "Huey Cobra," Online at <http://www.aviastar.org/helicopters_eng/bell_ah-1.php> (accessed April 12, 2008).

¹⁰⁷Robert Hall and Andrew Ross, "Lessons from Vietnam: Combined Arms Assault against Prepared Defences," In *Land Warfare Studies Centre (LWSC) Working Papers No. 122, From Breitenfeld to Baghdad: Perspectives on Combined Arms Warfare* - pp 27-52, Edited by Michael Evans and Alan Ryan, Duntroon, AUS: Land Warfare Studies Centre, July, 2003, 39-40.

¹⁰⁸Stubbs, Mary Lee and Stanley R. Connor, "Armor-Cavalry Part I: Regular Army and Army Reserve," *Army Lineage Series*, Online at <<http://www.history.army.mil/books/Lineage/arcav/arcav.htm>>, Washington, D.C.: Office Of The Chief Of Military History United States Army, 1969 (accessed April 14, 2008).

¹⁰⁹11th ACR History, Online at <<http://groups.msn.com/11thArmoredCavalryRegiment/11thacrhistory.msnnw>> (accessed April 14, 2008).

¹¹⁰Ibid.

¹¹¹Ibid.

¹¹²Citino, *Blitzkrieg to Desert Storm*, 288-289.

¹¹³Ibid., 302-303.

¹¹⁴Ibid., 264.

¹¹⁵Ibid., 263.

¹¹⁶Ibid., 289.

¹¹⁷Evans, "General Monash's Orchestra," 19.

¹¹⁸Ross Kerber, "US Forces Have Learned to Weather Sand," *The Boston Globe*, March 23, 2003, Online at <<http://www.globalsecurity.org/org/news/2003/030323-sand01.htm>>, Copyright 2003, Globe Newspaper Company (accessed April 12, 2008).

¹¹⁹ROVER III Terminal, "ROVER Sics TacAir on America's Enemies," *Defense Industry Daily*, Posted September 10, 2007, Online at <<http://www.defenseindustrydaily.com/rover-sics-tacair-on-americas-enemies-updated-01700/>>, Copyright 2004-2008 Defense Industry Daily, LLC in association with Watershed Publishing, LLC. (accessed April 12, 2008).

CHAPTER 4

COMBINED ARMS WARFARE ENABLING CAPABILITIES

Infantry is the arm which in the end wins battles. To enable it to do so the co-operation of the other arms is essential; separate and independent action by the later cannot defeat the enemy.

U.S. Army Field Service Regulations, 1924¹

This chapter details the 13 combined arms enabling capabilities that mechanized BCTs need to possess if they are to be successful in 21st century combat. Enabling capabilities are those capabilities necessary to conduct combined arms operations on today's complex battlefield, given the significant changes to the operational environment since the Korean War. Today, a combined arms approach to war requires not only that a commander employ various arms in a supporting and complimentary manner, but that he also possess certain enabling capabilities when conducting combat operations. In other words, being able to conduct effective combined arms operations on the 21st century battlefield depends on more than just using various arms together. Success is now dependant on possessing and employing additional capabilities. Another way to view these enabling capabilities is to look at them as upgrades that adapt the combined arms approach to war to the 21st century. With awareness of the importance of enabling capabilities, it becomes easier for commanders to conduct effective combat operations in today's complex and demanding operational environment. Without awareness of the need for employing these 13 enabling capabilities, mechanized BCTs could risk potential defeat on the modern battlefield, even by adversaries who are technologically inferior.

The fundamental nature of CAW remained relatively stable through the end of the Korean War. Commanders attempted to employ and synchronize as many battlefield

arms in a complimentary and supporting manner as possible in any given operation. Doing so ensured that vulnerabilities of a particular arm would be offset by the strengths of another. For example, the vulnerability of tanks to overhead attack by enemy aircraft in World War II could be somewhat nullified by the integration of self-propelled antiaircraft weapon systems into tank units. This approach worked well until significant changes in the operational environment began to take place.

Following the Korean War, dramatic changes on the battlefield began to impact how combined arms operations would need to be conducted. These changes were driven by three major trends that significantly changed the operational environment in which mechanized units now operate, leading to the need for combined arms enabling capabilities. The first major trend was the increase in accuracy and lethality of man-portable weapons. Weapons such as the handheld rocket propelled grenade (RPG) launcher, surface-to-air missile, antitank guided missile, and others began to dramatically increase the lethality of the individual enemy combatant on the battlefield. This trend has given a single enemy combatant the power to destroy a major weapon system, such as an M1 tank, an AH-64 Apache attack helicopter, or an F/A-18 jet. The second trend is the movement away from a linear battlefield to a non-linear battlefield, resulting in both the disappearance of friendly rear areas and the emergence of enemy combatants in areas previously considered safe. Today, even unit FOBs are not considered safe, as they continue to be on the receiving end of mortar and rocket fire. In addition, this trend means that what have traditionally been lightly armed and protected, rear echelon units are now extremely vulnerable to enemy attack. The third major trend is one of low-tech adversaries attacking soft targets with low-tech weapons. Examples of this trend include

RPG attacks by Somali militia members against lightly armed Army UH-60 helicopters during Operation Restore Hope in October, 1993, and the use of sniper rifles by insurgent forces against individual American soldiers in urban centers in the ongoing Iraq War. This trend exploits numerous and often extremely narrow (niche) vulnerabilities in modern Army tactics and equipment. Some of these vulnerabilities can be overcome quickly by simply changing unit tactics (e.g., flying at higher elevations), while others require significant amounts of time and resources to remedy (e.g., the procurement and fielding of sniper detection systems). These three trends have significantly changed the operational environment in which mechanized units are now fighting.

The more the U.S. Army can build these 13 combined arms enabling capabilities into mechanized BCTs as organic capabilities, the easier it will be for BCT commanders to employ them. However, if these 13 capabilities cannot be built into a unit, then a BCT's higher headquarters must be able to provide them. For example, one of the 13 enabling capabilities is vertical flight lift aviation, in other words lift helicopters. If this capability is not an organic capability within the structure of a particular mechanized BCT – such as an organic lift helicopter unit – then the BCT's higher unit must be able to provide lift helicopters to the BCT when they are required.

An important point for understanding this chapter is that these 13 combined arms enabling capabilities apply for all mechanized BCTs, whether the unit is officially type classified as an armor BCT, mechanized infantry BCT, Stryker BCT, or FCS BCT. This thesis does not address combined arms enabling capabilities for non-mechanized infantry units, such as light infantry BCTs, airborne BCTs, air assault BCTs, or the 75th Ranger Regiment. However, for those interested, the author's initial analysis indicates that there

are only three additional enabling capabilities that would apply to infantry BCTs; they are paraborne air assault, heliborne air assault, and air movement. Paraborne air assault simply means assaulting from parachutes (an airborne operation), while heliborne air assault refers to assaulting from helicopters (a typical air assault operation). Air movement, on the other hand, is concerned with the moving of troops and equipment via helicopter quickly from one place to another. Unlike an air assault, in an air movement operation forces are simply being moved from one location to another. The need for air movement for infantry BCTs arises out of two separate issues; the first of which is that these units are often utilized in restricted terrain, an environment requiring a considerable amount of lift aviation support to maintain tactical mobility, and the second reason is the overall lack of organic wheeled transportation within infantry BCTs.

One might also notice when studying the 13 enabling capabilities that at least with respect to organizational structure, a mechanized BCT with all 13 capabilities looks a lot like an ACR. This is primarily due to the fact that an ACR has both organic attack and lift aviation aircraft. This means that from a combined arms perspective the Army got it about right when creating the ACR. If one is looking for the best model of a brigade size, mechanized, combined arms unit, then the ACR is without a doubt the best model that the Army has yet created. The ACR model is not perfect and it can still be improved upon, but it is a great starting point.

Another important point is that these 13 enabling capabilities do not negate the need for individual arms, such as the requirement for air defense, engineer, artillery, or tanks. Rather, the enabling capabilities compliment the individual arms already organic in today's mechanized BCTs. For instance, the enabling capability of gap crossing does

not mean that this is the only engineer related capability that should be organic to a mechanized BCT. Rather, it simply means that without a gap crossing capability the BCT will be seriously challenged to maintain battlefield mobility when faced with even the smallest physical obstacle, such as a small river or damaged bridge. Even with gap crossing identified as an enabling capability, units will still need to maintain their traditional engineer assets, including combat earthmovers and mine clearing plows.

Identification of these 13 enabling capabilities once again raises the importance of the combined arms approach to war. It could even be the foundation for a new, modern, offensively oriented tactical doctrine. As such, a new Army-wide doctrine emphasizing combined arms operations and the need for employing enabling capabilities could be called Integrated Combat, meaning that a combined arms approach should be integrated into every type of combat operation, from a movement to contact to a ground convoy.

An awareness of the important role played by these 13 enabling capabilities is crucial to the understanding of the combined arms approach to war; especially now, as the Army continues to conduct combat operations in an ever more complex operational environment. Only through the understanding of these 13 enabling capabilities, depicted in Figure 9 below, will the Army be able to ensure that mechanized BCTs have the organic capabilities they require on the modern 21st century battlefield. Additionally, the awareness of these capabilities will result in BCT commanders who are better trained and educated in the finer points of combined arms operations.

Combined Arms Warfare Enabling Capabilities

- 1 – On The Move Communications**
- 2 – Airborne Command & Control**
- 3 – Close Air Support (CAS)**
- 4 – Ground Based Indirect Fires**
- 5 – CBRNE Protection**
- 6 – Ground LOC Sustainment**
- 7 – Ground Resupply**
- 8 – Aerial Resupply**
- 9 – Night Fighting**
- 10 – Gap Crossing**
- 11 – Vertical Flight Attack Aviation**
- 12 – Vertical Flight Lift Aviation**
- 13 – Information Operations**

Figure 9. The 13 Enabling Capabilities all Mechanized BCTs Must Possess

On-The-Move Communications

Reliable, consistent, on-the-move communications is one of the most central components of CAW. In World War I major operations were pre-planned in extreme detail. However, once the operation began communications between echelons often depended on either runners or radios of limited range. In addition, these radios could only be used when at the halt, making effective communications during the exploitation phase of a battle extremely difficult, if not impossible. It was not until radio technology progressed significantly that the German military was able to place radios in their vehicles and true on-the-move communications was achieved for the first time. This capability enabled German forces in World War II to create blitzkrieg tactics. Certainly, many other factors were involved which led to the creation of blitzkrieg tactics, but the

high speed of German combat operations was due in large part to on-the-move radio communications.

As noted earlier in this study, modern tactical FM radios typically have ranges of only 20-30 kilometers, and even less in urban terrain. Today, mechanized units employ SATCOM radios, which have worldwide range. These radios can be used on-the-move in a limited fashion, due to the fragile nature of current SATCOM antennas. They are primarily used for voice communications. It can be expected that in the future the Army will procure and field SATCOM radios – along with ruggedized SATCOM antennas – for all combat vehicles, similar to how the German military outfitted its vehicles with FM radios in World War II.

Today, in addition to FM and SATCOM voice radios, military units also communicate using internet-like digital networks. These networks are accessed using SATCOM antennas and they allow units to pass digital orders and graphics. One example of a digital network in action was mentioned in a Rand Corporation study published in 2007, titled “Networked Forces in Stability Operations,” which makes positive references to how one unit in Iraq, the 3rd BCT of the 2nd Infantry Division, was able to use its FBCB2 (Force XXI Battle Command Brigade and Below) computer terminals to pass critical targeting information to its subordinate units while on-the-move:

...the devices’ capability to receive and display digital orders, [high value target] locations and graphics on the move...significantly improve[d]...op tempo and agility...Digital orders, precise target coordinates and graphics reduced the time for planning and briefing cycles...[The] ability to receive this information in the field and on the move further accelerated the dissemination of intelligence and command information.²

With Army units now utilizing digital networks to pass critical information, the speed at which combat operations are conducted is further dependent upon units possessing on-the-move communications abilities.

The evidence is clear that on-the-move communications is a tremendous enabler for modern combined arms operations. All units should maintain an FM radio capability, but for voice communications at greater distances than FM radio allows, or when in urban terrain, SATCOM radio is required. Additionally, as information becomes ever more network-based, the need for robust tactical, digital networks with an on-the-move ability will also increase.

Airborne Command & Control

Airborne command and control is another enabling capability. This capability involves using an airborne platform, such as a helicopter or unmanned aerial system (UAS), to allow a commander to observe and control his forces from the air. Just as indirect fire observation and adjustment is often best accomplished from the air, so too is command and control. However, until the advent of the modern UAS very few mechanized unit commanders actually had this capability. Until then it was primarily an option only available to commanders in units with organic helicopter units, such as the brigades within the 1st Cavalry Division or the 101st Air Assault Division.

One mechanized unit with the organic capability for airborne command and control in the Vietnam War was the 11th ACR. The unit's regimental and squadron commanders often commanded during the battle from UH-1 Hueys. A good illustration of the effectiveness of this enabling capability occurred on the morning of November 21, 1966, when the Viet Cong's 247th (Dong Nai) Regiment attacked a supply convoy with

over 80 vehicles being escorted by elements of the 11th ACR's 1st Squadron. The convoy was moving west of Xuan Loc along Hwy 1, near the hamlet of Ap Hung Nghia, when at approximately 1025 hours the 247th Regiment commenced its ambush.

In the resulting chaos, numerous trucks and ACAVs were destroyed. However, within minutes the 1st Squadron commander, Lieutenant Colonel Martin D. Howell, was over the ambush site controlling numerous aspects of the unfolding battle from his UH-1 Huey. From his location he could clearly see not only the actions taking place on the ground, but also the helicopters and fixed wing aircraft beginning to make runs against enemy ground targets. Lieutenant Colonel Howell, in radio contact with the convoy commander on the ground, was able to direct the locations of air strikes so that they targeted enemy units near the road which were still attacking the convoy. He also provided direction to attack helicopter crews. Finally, from his ideal vantage point he was able to formulate a plan for where to employ two of his companies, C Troop and D Company, both of which had been launched as a large squadron quick reaction force.³ Lieutenant Colonel Howell attempted to use C Troop and D Company to trap the 247th Regiment's main body, preventing large numbers of its soldiers from escaping.

In the end, most of the 247th Regiment escaped, and only a handful of Viet Cong were killed. However, due in large part to the quick actions of the squadron commander, the ambush was defeated within minutes of its start. The use of an airborne platform allowed Howell to be over the ambush site quickly and begin to synchronize critical actions from above, all the while maintaining excellent situational awareness throughout the battle.

Today, UASs offer another way in which commanders can conduct command and control from an airborne vantage point. For units that do not have organic lift helicopters, UASs are their only option for airborne command and control. When employing UASs in this role, commanders need to be aware that UASs have strengths and weaknesses. Their primary strength is their ability to zoom in very closely and see the details taking place at one small area of the battlefield, providing excellent detail of events unfolding below. In contrast, their main weakness is that they are not very good at zooming out and giving commanders an overall big picture view of how the entire battle is progressing.

Close Air Support (CAS)

The enabling capability of close air support (CAS) is very important to ground combat operations. It augments ground based indirect fires and has traditionally been the best means to deliver precision fires. Aircraft can destroy any type of ground target, to include vehicles, bunkers, and even individual enemy personnel. Unlike ground based artillery, fixed-wing aircraft can deliver large munitions, as large as 2,000 pound bombs. Due to the size of these munitions, both the physical and psychological effects of CAS on enemy personnel can be much more traumatic than that of artillery. Besides bombs, fixed-wing aircraft also normally carry a 20mm gun they can use for ground strafing. The gun is very accurate and has a relatively minor risk of collateral damage.

Consisting of “air action by fixed or rotary-wing aircraft against hostile targets in close proximity to friendly forces,” CAS requires the detailed integration of air missions with the fire and movement of ground forces.⁴ Close air support missions can be either preplanned or ad hoc, but either way require close coordination with ground units to

ensure fratricide does not take place. Close air support should also be employed with a desired effect in mind. Aerial bombing will not always kill enemy personnel, but if it gets them to surrender or withdraw, then it will have achieved the same effect of removing the enemy point of resistance.

In today's counterinsurgency (COIN) environment, Army forces often find themselves operating in small groups, separated by great distances. Whether a 10 person military training and transition team or simply a platoon operating at a remote outpost, these groups are not always able to be covered under the protective umbrella of ground based fires. In these instances CAS provides the only means of indirect fires for small units operating in a widely dispersed fashion.

In their book, *Fire-Power*, military historians Shelford Bidwell and Dominick Graham state that CAS played an important role in the outcome of World War II's Operation Market Garden. They argue that an important reason why the British 1st Airborne Division failed in 1944 to seize the main Arnhem bridge during Operation Market Garden at Arnhem, The Netherlands, is that in their hasty planning process the British failed to plan for CAS in support of the operation.⁵ While at first glance this idea that air support might have made a significant difference for the 1st Airborne soldiers at Arnhem seems not to have merit, yet if one looks at it from a larger perspective it just might be true. Viewed in a larger context of the entire operation, not just the Arnhem portion, had the Allies dedicated an extremely large number of CAS sorties per day to the overall operation, then this might have helped Allied forces punch through to Arnhem in time to save the isolated 1st Airborne Division.

Close air support is a powerful combined arms enabling capability. At the conclusion of World War II, when speaking about the importance of CAS, Major General J. Lawton Collins, the American VII Corps commander, remarked, “We could not possibly have gotten as far as we did, as fast as we did, and with as few casualties, without the wonderful air support that we have consistently had.”⁶ Clearly, the versatility of CAS makes it a tremendously important combined arms enabler.

Ground Based Indirect Fires

This enabling capability reminds us that all operations should be covered by ground based indirect fires. As noted in the previous section on CAS, Army units cannot always be covered by ground based fires; however, whenever possible, they should be. While CAS offers a tremendously powerful means of indirect fires, commanders who allow combat operations to take place without planning for supporting ground based fires run the risk that friendly units will not have indirect fires when bad weather prevents aircraft from providing it. In addition, occasions exist when airborne CAS is not the best solution to the tactical problem. This enabling capability exists to remind commanders of the importance of planning for the potential use of ground based fires (mortars, artillery, and surface-to-surface rockets) in all operations, no matter how small the operation.

As far as precision is concerned, today, Army ground based fires have become almost as precise as those provided by Air Force CAS. The Army is currently working on development of the M395 Precision Guided Mortar Munition (PGMM), a 120mm mortar round guided by GPS coordinates. In addition, the Army has already begun issuing to its 155mm artillery capable units the M982 Excalibur 155mm guided artillery shell, which also operates from GPS coordinates.

One example from the Iraq War best illustrates the importance of having ground based fires available to support combat operations. The battle took place as part of the initial ground invasion of the Iraq War. From 25 to 31 March, 2003, the 3-7 Cavalry Squadron (3-7 Cav), an element of the 3rd Infantry Division, made a feint north across the Euphrates River near the city of As Samawah in an attempt to draw Iraqi forces south, and away from Baghdad. As enemy units took the bait, 3-7 Cav was heavily engaged by Saddam Fedayeen fighters as they attempted to destroy the squadron's M1A2 tanks and M2 Bradley Fighting Vehicles. The fighting continued as an intense sandstorm rolled in, creating conditions under which airborne CAS was unavailable. Critically low on ammunition, waves of Iraqis almost overwhelmed the squadron near the end of the battle, and the unit was only able to disengage from Fedayeen forces after 3rd Infantry Division artillery and rocket attacks destroyed all attacking enemy forces.⁷ In this case, poor weather grounded all aircraft and prevented 3-7 Cav from utilizing CAS during the most critical phase of the battle. Only ground based indirect fires have a true all-weather capability.

Another classic example which illustrates the importance of ground based indirect fires involves the portion of the 1973 Arab-Israeli War fought on the Sinai Peninsula between Israel and Egypt. Employing mechanized brigades, without ground based artillery in support, Israeli forces suffered greatly at the hands of Egyptian forces. Instead of establishing balanced combined arms brigades prior to the conflict, Israeli forces decided to rely solely on fixed-wing aircraft for fire support. However, this proved an unwise decision, as during the conflict Egyptian forces were able to establish very effective anti-aircraft and anti-armor defenses. With Israeli aircraft neutralized and

unable to provide fire support, mechanized brigades on the ground did not have the fire support they needed to defeat Egyptian anti-armor teams. In turn, this led to Egyptian forces inflicting heavy losses on Israeli mechanized brigades.

Units must plan for ground based indirect fires to support every major combat operation, and should not expect CAS to always be available. Indirect fires should be responsive, meaning they should be available within seconds or minutes. Units should not have to wait for the 10, 15, or even 20 minutes it may take for CAS aircraft to arrive over the battle area, which is an agonizingly long time for ground units in direct contact with enemy forces to wait for support. Another reason why CAS may not be available is that it is occasionally diverted to support operational or strategic level objectives, such as striking an operational level time sensitive target (TST). Given the fleeting nature of enemy targets, indirect fires should be available immediately when enemy targets present themselves on the battlefield.

CBRNE Protection

The term Chemical, Biological, Radiological, Nuclear, and Explosive Incidents (CBRNE) is not commonly used outside of select, specially trained hazardous materials response teams. Yet, it needs to be a term the general Army population is familiar with. It encompasses not only the common nuclear, biological, and chemical issues that combat forces have long been concerned with, but also includes issues about the potential use of dirty bombs on the battlefield (radiological), as well as preventing and responding to large explosive events. These explosive events are happening on the battlefield today, as insurgents attack American forces with items such as the improvised explosive device

(IED), explosively formed penetrator (EFP), and vehicle borne improvised explosive device (VBIED).

This combined arms enabling capability raises awareness of the importance of CBRNE to a new level. Now, units will be certain to address how they plan to protect themselves from elements of CBRNE during their pre-operation planning process. For example, if enemy forces have been employing IEDs in the area and there is a risk that an IED will be used to attack friendly forces, then a decision might be made to transport unit personnel inside mine-resistant ambush protected (MRAP) vehicles. These vehicles make it much safer to transport troops on roads along which IEDs have been emplaced.

With the formal establishment of protection as one of the six warfighting functions in the 2008 edition of FM 3-0, *Operations*, it only makes sense to make CBRNE responsibilities a part of the protection warfighting function. Additionally, as more units create protection cells within their BCT staffs, CBRNE prevention will likely become their primary planning focus. A heightened focus on CBRNE has the potential to significantly reduce the amount of soldier deaths to these types of dangerous events.

What is driving the need for the establishment of CBRNE as a combined arms enabling capability is the fact that CBRNE events are becoming ever more prevalent on the battlefield. Increased insurgent use of IEDs, EFPs, and VBIEDs are evidence of this fact. The need for MRAP vehicles is also an indicator of the need for this enabling capability.

As recently as the 2003 ground invasion of Iraq, American commanders believed there to be a very high probability that chemical or biological weapons would be used on the battlefield. It is also logical to expect that chemical or biological weapons may be

used on future battlefields. With increased proliferation of nuclear technology by North Korea, Iran, and possibly Syria, we can expect an increased nuclear threat on future battlefields. In addition to genuine fission and fusion weapons, protection is also needed against enhanced radiation/dirty bombs.

Establishing CBRNE Protection as an enabling capability also suggests that all combat vehicles in the future need to be designed from the start with protection in mind. Protection will need to be integrated into these vehicles during their initial concept phase, incorporating features designed to protect the occupants from all elements of CBRNE. Designing V-shaped hulls into combat vehicles is just one example. In this way, CBRNE Protection becomes an offensively oriented capability as well. The notion of CBRNE Protection cuts across elements of the entire mechanized BCT, from the design of combat vehicles to how logistics operations are carried out, and so is clearly an enabling capability for mechanized BCTs.

Ground LOC Sustainment

This enabling capability refers to the need to keep road networks (lines of communications, or LOCs) open and operational, allowing for the non-restricted movement of both combat forces and non-combat forces (e.g., civilian vehicular traffic) along road networks within the BCT's area of responsibility. This capability is obviously more applicable in a COIN environment than in a major combat operation (MCO). In an MCO, a BCT will normally either be defending from a specific location or else be moving forward on the attack; in either case they have little concern for the status of road networks within the area. However, in COIN the situation is dramatically different. In a COIN environment, once a BCT is assigned an area of responsibility the unit typically

stays within the boundaries of that area for the duration of its deployment. As such, keeping road networks open within those boundaries becomes the unit's responsibility.

Military units are not concerned with every single piece of road within their unit boundaries. Rather, they normally designate two sets of routes, main supply routes (MSRs) and alternate supply routes (ASRs). Units then move all military traffic along these designated routes. Since BCT operations are taking place along these two sets of roadways, the unit can focus its ground LOC sustainment efforts on these specific roads.

In a COIN environment, numerous ground convoys move across a BCT's MSRs and ASRs daily. Some are logistics focused convoys, but many are not. Some may simply be friendly forces conducting a mounted, vehicular patrol of the area. All convoys are attempting to fulfill their assigned missions of getting somewhere on the battlefield. Ground LOC sustainment provides safe, unrestricted road networks, enabling these convoys to reach their destinations.

Ground LOC sustainment does not mean road maintenance. Road maintenance is a task which can be contracted to civilian road construction companies. Rather, this enabling capability concerns a BCT's ability to maintain open LOCs, with freely flowing, unobstructed traffic. These are LOCs free of dangerous hazards such as IEDs or EFPs. While possibly a little confusing, since it normally refers to logistics, the word sustainment is the best word to describe the function of keeping LOCs open.

A combined arms approach to ground LOC sustainment is now commonplace in Iraq. Due to the proliferation of both EFPs and large roadside IEDs, this enabling capability is a daily routine for many units. In particular, the combined arms mission of route clearance is often assigned to units ahead of ground convoys. Beginning several

hours before a ground convoy moves along a particular MSR or ASR, a combined arms team of infantry, engineers, and military police will begin to move slowly along the route, looking for the presence of IEDs or EFPs. Any suspicious items are handled by the engineers, who use their specially adapted MRAP vehicles to get close enough to determine if it is indeed a threat. If an IED/EFP is detected, then explosive ordnance disposal (EOD) personnel are brought forward to neutralize the item. In addition, while these activities are taking place on the ground, unmanned aerial systems (UASs) are employing their sensors to search along the route for any traces of newly emplaced IEDs/EFPs. These aircraft can also observe specific routes for many hours at a time, attempting to spot enemy personnel in the act of actually emplacing IEDs/EFPs along the roadway. If these enemy personnel are observed emplacing such a device, then AH-64 Apache attack helicopters can be directed to the location to target the individual/s.

Having safe, unrestricted LOCs allows units to carry out combined arms operations in a COIN environment. The majority of offensive combined arms lethal operations (lethal actions) carried out in this type of operational environment are either raids or cordon and searches. Ground LOC sustainment operations are sometimes carried out prior to these operations, so that a raid or cordon and search will go smoothly and not be encumbered by IED or EFP attacks. Ground LOC sustainment is clearly an enabling capability for combined arms operations in a COIN environment.

Ground Resupply

It has been said that, “what cannot be supported logistically cannot be accomplished tactically.”⁸ On today’s battlefield, conducting resupply operations by ground requires a combined arms approach. Referring back to the example discussed in

the section on airborne command and control on the 11th ACR's convoy escort along Highway 1 in Vietnam, one can see in that example that employing a combined arms approach to ground resupply is necessary in the post-Korean War operational environment.

The battlefield framework fully changed over from linear to non-linear following the Korean War. From that point forward, units conducting ground resupply operations have needed armed convoy escorts at all times. The success achieved by the 11th ACR at preventing wholesale destruction of the large convoy it was escorting is indicative of the value of taking a combined arms approach to ground resupply.

Unlike the Vietnam War, enemy forces fighting in Iraq and Afghanistan today are operating on a much smaller scale. In Vietnam, entire enemy regiments or even divisions engaged American forces, whereas today, enemy formations of more than 50 fighters are rare. However, unlike Vietnam, today's small groups of fighters can cause the same damage as a Viet Cong battalion or regiment by conducting complex ambushes consisting of IEDs, RPGs, and small arms.

Mujahideen attacks against Soviet helicopter forces in Afghanistan during the Soviet occupation of that country indicate that ground resupply is often the best means to provide logistics in support of distributed combat operations. Using shoulder fired surface-to-air missiles, mujahideen fighters often attacked Soviet helicopters from high mountain passes. These helicopters were attempting to distribute supplies to remote outposts. These attacks forced the Soviets to move the majority of their logistics by ground. Then, mujahideen fighters attacked Soviet ground convoys as they attempted to distribute supplies to remote locations. Remote outposts became ineffective if not

resupplied on a regular basis, thus becoming unable to project combat power outside of their tiny outpost. This example shows that if ground resupply is able to get needed logistics to remote bases it is a tremendous combined arms enabler.

The enabling capability of ground LOC sustainment is not the same as ground resupply. Ground LOC sustainment does not directly deal with logistics. It deals with logistics in an indirect fashion, but only in that logistics convoys may be passing along an MSR or ASR which has been cleared by a unit conducting a ground LOC sustainment type operation, such as route clearance. On the other hand, ground resupply does deal directly with logistics, and informs us that maintaining a strong ground resupply capability is the best guarantee that units will have the logistics needed to carry out sustained combined arms operations.

Aerial Resupply

For mechanized BCTs that are located great distances from a logistics base, ground resupply may not be the best option. In this case, aerial resupply offers several advantages. First, a BCT can get critically needed supplies much quicker through aerial resupply than through the use of ground convoys. Second, depending on the tactical situation, a BCT may not have enough combat power available to dedicate towards providing adequate protection in escorting ground convoys through unassigned, enemy controlled areas. Third, with the advent of precision airdrop capabilities, aerial resupply looks to be a much less costly means of conducting resupply for combat units than ground convoy. Lastly, the enemy threat against convoys may be so great that the commander may decide it is not worth the operational risk of conducting them. This is a similar scenario to that which American BCT commanders found themselves in from

2005 to 2007 in Iraq. In this case, the threat of attack by insurgent forces in Iraq caused grave concern that the risk to ground convoys of being attacked and defeated while transiting to and from a friendly logistics bases may not have been worth the risk in potential American lives lost.

Logistics clearly enables combined arms operations. Without their continuous resupply, mechanized BCTs can only remain effective for a period of several days. Of course, a large amount of logistics needed by mechanized BCTs consists of fuel for its vehicles, but fuel can also be delivered by air.

All BCTs need to have the capability to conduct resupply through aerial means. If a BCT commander intends to conduct resupply primarily through ground convoys, then the unit should plan for aerial resupply operations as a backup resupply system. If enemy forces are able to attack and destroy a ground convoy, then aerial resupply operations will ensure the BCT gets the supplies it needs.

Today, aerial resupply technology has progressed to the point where precision airdrops are quite capable. In fact, the U.S. Air Force has been employing the self-guided joint precision aerial delivery system (JPADS) in both Iraq and Afghanistan since August, 2006. The JPADS equipped parachutes are capable of delivering a pallet of up to 2,200 pounds of supplies to remote or dangerous areas using GPS coordinates. Aircraft can drop JPADS equipped pallets from up to 25,000 feet and have the pallet land within 100 meters of its intended target location. As of January, 2008, an estimated 500 ground convoys have been kept off Iraqi roads through the use of JPADS.⁹ This type of precision airdrop capability provides units with resupply options other than just ground convoys.

Mechanized BCTs cannot conduct combined arms operations for sustained periods without resupply, and aerial resupply is often the preferred method in remote or dangerous areas. Conducting resupply by air can save critical combat power that would have been otherwise used to escort ground convoys. In today's operational environment, where there no longer exist any truly safe rear areas, an aerial resupply distribution system utilizing precision airdrop makes sense, preserving needed combat power for the unit's most critical combat operations and thereby enabling combined arms operations.

Night Fighting

If combined arms operations are to be conducted at night, then night fighting is certainly a necessary enabling capability. Night fighting involves maintaining both the technological edge and the training proficiency required to conduct effective operations in hours of darkness. The ability to conduct nighttime combat operations against an enemy force that is unable to fight at night can also create a tremendous psychological advantage in combat.

In World War II Red Army forces understood that night fighting was a capability they had to master if they were to beat the Germans. While German units were extremely proficient at daytime combined arms fighting, the Soviets noted during the Battle of Stalingrad that German forces were often reluctant to fight at night and correctly deduced that one of the best ways to "reduce the German advantage of tank and air superiority was to fight the Germans at night."¹⁰ For the Red Army, night operations proved to be a very effective technique of countering the German combined arms style of fighting. If current American combat units are not capability of fighting at night, then they risk bringing

about a similar fate as that which befell German forces in Stalingrad, whereby a low tech, yet ideologically motivated adversary, defeated a combined arms force.

An important component of night fighting involves the use of aircraft. Aircraft normally possess the most effective nighttime sensors, often carrying thermal imagers. Additionally, enemy activity is often easier to detect at night, as reduced civilian traffic tends to make enemy activity stand out. This creates a situation whereby using UAS platforms to find targets and ground attack aircraft to strike these targets is often the best means to conduct night fighting to enable ground combined arms operations.

In November, 2004, during Operation Phantom Fury, U.S. Marine combined arms units focused their nighttime activity on this type of tactic. In particular, they coordinated for an Air Force AC-130 (Spectre) to be continuously in orbit above the city of Fallujah throughout the night to attack enemy targets as they presented themselves. These gunships engaged ground targets with 20mm, 40mm, and 105mm rounds through the night, and allowed ground units to carry out nighttime operations on their terms. Concerning nightly Spectre gunship operations, Lieutenant Colonel Willard Buhl, commander of the 3rd Battalion, 1st Marine Regiment, stated:

We were never attacked by the enemy after dark throughout the entire campaign. We were able to run security patrols, consolidate gains [made] during the day, rest and plan for the next morning's attack, because of [Spectre].¹¹

Nighttime close air support provided by Spectre and other aircraft, in close coordination with UAS, is often the best means of employing the night fighting enabling capability.

Conducting effective combined arms operations at night requires not only that we maintain our technological superiority, but also that our forces remain trained on how to conduct night fighting. Today, with modern night vision technology, U.S. forces can see

in all but the darkest nights. American technological superiority allows for the equipping of all types of personnel, from the infantry soldier to the helicopter pilot, with the latest night vision devices. Nighttime combat training must be done periodically so that units can practice the intricacies of night combat, keeping their night fighting skills honed and ready. The enabling capability of night fighting, consisting of night vision technology and night combat proficiency training, allows combined arms units to effectively own the night against any adversary.

Gap Crossing

The inability to cross short, simple gaps has been one of the main obstacles to mechanized forces since their inception in World War I. One can find numerous photos of World War I tanks abandoned after getting stuck in a trench and unable to get out. The gap crossing enabling capability addresses this most basic issue of mechanized combat. Essentially, this enabling capability approaches mobility from the standpoint that, at the very least, a mechanized BCT must be able to cross gaps if it is to maintain some modicum of battlefield mobility. Without a gap crossing capability, a mechanized BCT is too limited in where it can maneuver during combat.

All modern, mechanized armies maintain specialized vehicles designed to span gaps. Most can span a gap approximately 20 meters in width. The U.S. Army's current vehicle is the M104 Wolverine, which can span a 24 meter wide gap. The Wolverine has a crew of two and carries a 26 meter long heavy assault bridge on an M1A2 chassis. The bridge allows up to class 70 vehicles (e.g., an M1A2 tank) to cross obstacles such as large ditches and cratered road bridges (created by aerial bombing). Most importantly, since the Wolverine uses the exact same M1A2 chassis as the tanks it must support, its chassis

has the same mobility and survivability as the M1A2. Two Wolverine vehicles are organic to every mechanized BCT, and are maintained by the BCT's engineer company.¹²

On April 7, 2003, U.S. Marines used a heavy assault bridge very similar to the type carried by the Wolverine to cross the Diyala River, as part of their final push into Baghdad. A portion of a large vehicle bridge along the highway leading into Baghdad had been destroyed, but Marine combat engineers determined they might be able to span the gap created by the destroyed portion of the bridge by utilizing an armored vehicle launched bridge (AVLB). They brought the bridge forward and successfully placed it across the gap in the damaged bridge, which allowed the Marine column to fight their way into the capital.¹³

All future Army mechanized BCTs will need to maintain a gap crossing capability if they are to maintain their tactical mobility. While larger bridges are needed to span larger obstacles such as rivers, the Wolverine vehicle and its heavy assault bridge are able to span many smaller tactical obstacles which might otherwise stop armored vehicles. As demonstrated by the example of the Marines, armored mobility depends to a large degree on maintaining the ability to span short gaps.

Vertical Flight Attack Aviation

This enabling capability refers to the need for attack helicopters to participate in mechanized BCT combat operations as a member of a combined arms team. It is titled vertical flight attack aviation because tilt-rotor aircraft could conceivably also do the same job. Clearly, the need for attack helicopters in support of combined arms operations has already been well established through their participation in numerous military

conflicts. They have proven of tremendous value since their first use on the battlefield in Vietnam. Considered a form of close air support, ideally a company of attack helicopters would be organic to every mechanized BCT in the Army. However, this is very unlikely to happen, as helicopters are expensive to purchase and to sustain over the long term.

As a general rule, commanders should strive to provide protective air cover over their forces during every combat operation. Attack helicopters are designed for close integration with ground forces, and traditionally offer loiter times of between one to two hours. Ground maneuver elements can easily talk with attack helicopter pilots, since both share the same types of FM radios and encryption.

Attack helicopters are just as capable, and just as much a force multiplier in stability and COIN operations, as they are in major combat operations (MCO). Major combat operations can be defined as combat between large, heavily armed conventional formations fighting for military supremacy by attempting to “...defeat or destroy the enemy’s armed forces and seize terrain.”¹⁴ In a COIN environment, they are excellent at responding quickly to time sensitive targets on the battlefield. Examples of time sensitive targets were Saddam Hussein’s sons, Uday and Qusay Hussein, who were killed by American forces in Mosul, Iraq, on July 22, 2003. Attack helicopters are also good at maintaining contact with small enemy targets, such as single vehicles or individuals, whereas it is very difficult for a fixed-wing strike aircraft to track a potential target for any length of time.

Normally flown in pairs, attack helicopters can employ hydra rockets, Hellfire missiles, and 25mm guns. They can also hover near a target area for between one and two hours. In Iraq they have been used very successfully in manned-unmanned teaming

situations which place UAS working with AH-64 Apaches to identify, then attack IED emplacements along MSRs and ASRs. As part of Task Force ODIN (Observe, Detect, Identify, and Neutralize), UASs traditionally perform the first three steps and Apaches provide the firepower to perform the “neutralize” function. An innovation in combined arms tactics, the linking of UASs and Apaches has, in the opinion of Major General Jim Simmons, the commander of TF ODIN, been the decisive factor in the fight against IEDs in Iraq.¹⁵ According to Simmons, the process shortens the sensor to shooter loop and normally involves making decisions concerning the issue of whether to “take out the emplacements or do we follow them back to their cache site?”¹⁶

Attack helicopters are a significant member of the combined arms team. They bring tremendous airborne firepower to bear in support of COIN and MCO operations. They are able to overcome ground obstacles and serve as stable and effective airborne direct fire platforms. Mechanized BCT operations benefit greatly from the combined arms enabling capability of vertical flight attack aviation during all combat operations.

Vertical Flight Lift Aviation

Similar to the previous enabling capability, this one is titled vertical flight lift aviation, because tilt-rotor aircraft could also conceivably perform this function. The large operational areas in which mechanized BCTs operate on today’s battlefield suggest that lift helicopters need to be organic to each mechanized BCT. Of course, it is unlikely the Army can field lift helicopter companies to each BCT, due to their high cost and maintenance demands. More to the point, mechanized BCTs need to have access to this capability when their missions require it. If lift helicopters are not organic components of

a mechanized BCT, then they certainly need to be made available to the unit to support specific battlefield missions as these arise.

Lift helicopters (primarily the UH-60 Blackhawks and CH-47 Chinooks in the Army's current inventory) can potentially serve many functions at the BCT level, to include: troop transport, medical evacuation, and aerial resupply. In today's operational environment, if all BCTs had their own organic lift helicopters they could move the vast majority of their unit's supplies by air, thereby significantly reducing the amount of ground convoys required to travel along routes that may be IED infested. Additionally, if they had organic lift aviation assets, all commanders could conduct airborne command and control during combat operations.

Information Operations

Designating information operations (IO) as a combined arms enabling capability establishes two things. First, it addresses the need to integrate IO into combat operations, both lethal and non-lethal. Second, it brings into combined arms planning and execution a mechanism by which units can influence the civilian population so that the population supports American forces and their allies and not the enemy. Far too often, deployed BCTs take little to no action to engage the local population and win their support.

Army FM 3-13, *Information Operations*, explains that the term information operations includes "...attacking adversary command and control (C2) systems (offensive IO) while [simultaneously] protecting friendly C2 systems from adversary disruption (defensive IO)."¹⁷ It further states that information operations involves the employment of the five functions of electronic warfare, computer network operations, psychological operations, military deception, and operations security...to affect or defend

information and information systems, and to influence decisionmaking.¹⁸ These two definitions are certainly broad enough in their scope to allow for various aspects of IO to be integrated into both lethal and non-lethal combat operations.

With this description, how can IO be utilized to influence the civilian population? The answer can be found in the functions of computer network operations, psychological operations, and military deception. Each of these three functions allows for means by which a BCT can begin to influence the surrounding civilian population. With the computer network operations function a BCT can conduct operations to take down local insurgent websites in the area. An example would be websites attempting to recruit fighters against U.S. forces. Members of a BCT could even pay an internet service provider or local police to accomplish this task, rather than doing it themselves. The function of psychological operations, on the other hand, involves employing radio, TV, or print media to educate and influence population members. Finally, the military deception function involves deliberately misleading adversary decision makers who are often hiding amongst the population as to friendly force intentions so that friendly units can accomplish their objectives. These are three ways a mechanized BCT can use IO to influence the local civilian population.

To be effective at information operations units must devote a significant amount of time – and often resources – towards making the five IO functions work effectively. In addition, there are weekly planning meetings (e.g., the IO Working Group meeting) that a unit must hold in order to coordinate and synchronize IO with both lethal and non-lethal actions taking place on the battlefield. Units must synchronize their own IO themes with those themes being promoted by their higher headquarters. Finally, the

targeting process often places heavy demands on personnel involved in IO to provide important inputs to both the lethal and non-lethal targeting processes. Overall, successful information operations involve the employment of the five powerful IO functions, which mechanized BCTs can use to both integrate IO into combat operations and to influence the civilian population.

¹U.S., Department of the Army, *Field Service Regulations, United States Army (Operations)*, Washington, D.C.: Government Printing Office, 1924, 12.

²Paul McLeary, “Rand Corp. study finds technology is more effective than force size,” *Defense Technology International*, Aviation Week, Copyright 2008, The McGraw-Hill Companies, Inc., December, 2007, 21.

³Albright, John. “Convoy Ambush on Highway 1.” *Seven Firefights in Vietnam*. Office of the Chief of Military History, U.S. Army. Washington, DC: Government Printing Office. 2005, 56-57.

⁴U.S., Department of Defense, JP 3-09.3. *Joint Tactics, Techniques, and Procedures for Close Air Support (CAS)*, Washington, DC: Government Printing Office, September 2003, ix.

⁵Shelford Bidwell and Dominick Graham, *Fire-Power: The British Army Weapons & Theories of War 1904-1945*, S. Yorkshire, UK: Pen & Sword Book Limited, 2004, 273.

⁶Michael D. Doubler, *Closing with the Enemy: How GIs Fought the War in Europe, 1944-1945*, Lawrence, KS: University Press of Kansas, 1994, 63.

⁷Robert W. Rooker, “Historical Recounting of Marne Thunder in OIF.” *FA Journal*. Sept-Oct, 2003, Online at <http://findarticles.com/p/articles/mi_m0IAU/is_5_8/ai_110732256/pg_3>, Copyright 2008, CNET Networks, Inc. (accessed April 20, 2008).

⁸John L. Romjue, “The Evolution of the Airland Battle Concept,” Air & Space Power Home Page, *Air University Review*, May-June 1984, Online at <<http://www.airpower.maxwell.af.mil/airchronicles/aureview/1984/may-jun/romjue.html>> (accessed April 25, 2008).

⁹Army Technology.com, “Capewell Wins US\$1.6M Precision Airdrop Award from the Australian Department of Defence,” Online at <<http://www.army-technology.com/contractors/logistics/capewell/press9.html>>, Copyright 2008 SPG Media Limited, a subsidiary of SPG Media Group PLC., January 8, 2008 (accessed April 25, 2008).

¹⁰Antony Beevor, “Stalingrad: The Most Pitiless Battle in Modern History,” *World War 2: 2,194 Days That Changed Everything – World War II Magazine Special Collector’s Edition*, Leesburg, VA: Weider History Group, Inc., 2007, 34.

¹¹Ross Simpson, “The Fall of Fallujah,” *Tactical Weapons Magazine*, Volume 2, Issue 4, March, 2008, New York, NY: Harris Publications Inc., 78.

¹²Heavy Assault Bridge Basis of Issue Plan, Online at < <http://fas.org/man/dod-101/sys/land/docs/bnK056AA.htm>> (accessed April 26, 2008).

¹³Sean B. Fairburn, “Closing on Baghdad,” USAToday.com website, Online at < http://www.usatoday.com/news/world/iraq/2004-04-07-baghdad-closing_x.htm>, Copyright 2008 USA TODAY, a division of Gannett Co. Inc. (accessed April 26, 2008).

¹⁴U.S., Department of the Army, FM 3-0, *Operations*, Washington, DC: Government Printing Office, February 2008, 2-13.

¹⁵David S. Harvey, “ODIN Teams Terrorize the IED Terrorists,” *Defense Helicopter*, Volume 27, Number 1, Burnham, UK: Shephard Press Limited, January/February, 2008, 8.

¹⁶*Ibid.*, 9.

¹⁷U.S., Department of the Army, FM 3-13, *Information Operations: Doctrine, Tactics, Techniques, and Procedures*, Washington, DC: Government Printing Office, November, 2003, v.

¹⁸*Ibid.*, 1-13.

CHAPTER 5

THE CHANGING OPERATIONAL ENVIRONMENT

I'll tell you what I believe in terms of the future war fight. I think we're going to have to be faster, more practical, more adaptable, more lethal, more precise, [have] less [of a] footprint, [and be] more mobile...I think we will continue to evolve as an expeditionary force and I think you will see a lot of that happening in part because of the fight that we're in and what we're learning...and I think that will be a very important part of how we view the future.

ADM Mullen, CJCS, Fort Leavenworth, Kansas, October, 2007¹

In December, 1989, during the two-day Malta Summit aboard the Soviet cruise liner Maxim Gorky, Soviet leader Mikhail Gorbachev and U.S. President George H.W. Bush officially announced an end to the U.S.-Soviet Cold War.² Following this event, the global political environment began to rapidly change. States which had previously been under Soviet control were now free to chart their own political, economic, and military courses. In addition, issues began to arise which helped to destabilize the world politically. Factors such as unresolved ethnic tensions between states, humanitarian crises, international terrorism, the proliferation of nuclear technology, economic globalization, and access to the internet helped to fuel a time of rapid world transformation. These and other forces have shaped the current operational environment in which Army forces today are conducting military operations.

This chapter attempts to do two things. First, it seeks to determine what the operational environment will look like in 2015, when the first FCS equipped BCTs are activated within the U.S. Army. Second, it will then examine the effects of the 2015 operational environment on the 13 combined arms enabling capabilities outlined in the preceding chapter. Understanding the effects the 2015 operational environment will have

on these 13 capabilities is important. The FCS BCT will need to be able not only to survive on the 2015 battlefield, but also dominate it. It is essential to have a good understanding now of what the future battlefield will look like, as any potential weaknesses identified now can be remedied before FCS units begin to deploy into operational theaters.

An Era of Persistent Conflict

One thing everyone seems to agree on these days is that the U.S. military is in an era of persistent conflict that will last for a long time. There has been much public discussion during the past several years within the U.S. political and defense communities that the conflicts with Al-Qaeda (the Global War on Terrorism) and in Iraq (the Iraq War) will likely last through at least 2015, if not much longer. Eras typically have definitive beginning and ending dates, but while it can be argued that this era of persistent conflict began when the Cold War ended (1989), it is unknown how long this era will last and when exactly it will end. Three issues seem to be directly fueling this era of persistent conflict, and it is logical that until these three issues are resolved the era will continue unabated. The three issues, in order of precedence, are the Palestinian conflict, nuclear proliferation, and Al-Qaeda's war against the non-Arab world.

The Palestinian Conflict: First and foremost, the Palestinian conflict is the number one cause of the era of persistent conflict. The controversy centers on the desire by rulers of Arab countries to destroy Israel and give that land back to the Palestinians. Two major Arab-Israeli wars were fought over the Palestinian issue; the 1967 Six Day War and the 1973 Yom Kippur War. Over the years, Syria has worked to ensure Southern Lebanon is an area under radical Arab control, and that Christian and moderate

Arabs do not hold any real power. Numerous targeted killings of government moderates in Southern Lebanon over the years have likely been Syrian sponsored assassinations. Today, due in large part to years of Syrian efforts, Southern Lebanon is an area that is aggressively anti-Israel.

Iraqi and Iranian anti-Israeli efforts have also raised tensions. In 1981, Israel destroyed an Iraqi nuclear reactor it feared would be used to make nuclear weapons that could someday be used against Israel.³ Iraq was about to put the French-built nuclear plant into operation. Adding to Syrian efforts, the Iranian government's training and equipping of extremist guerrilla groups in Southern Lebanon, the West Bank, and Gaza have also dramatically increased military tensions in the area. Today, Iran is developing its own nuclear capabilities at a tremendous rate of speed, and all indications point to Iran someday using nuclear weapons against Israel once Iran has manufactured enough weapons so that a nuclear strike on Israel will be overwhelming and decisive.

The Palestinian conflict must be resolved, either through war or through a peace deal whereby the Palestinians are granted their own land and receive internationally recognized statehood. A sub-issue of this conflict deals with the city of Jerusalem, specifically ensuring that both Jews and Arabs have access to worship in the city. As long as the Palestinian conflict remains unresolved the era of persistent conflict will continue, as the entire Arab world will be focused on the injustice it believes Israel has done to the Palestinian people.

Nuclear Proliferation: The second factor fueling the era of persistent conflict is nuclear proliferation. The Palestinian conflict has been both enabled and emboldened by nuclear proliferation. The nuclear proliferation process likely began with a Pakistani

nuclear deal with North Korea in the early 1990s, whereby North Korea provided Pakistan with designs for long-range missiles in exchange for Pakistani designs for nuclear centrifuges.⁴ Indications are that following President Bush's labeling of North Korea as a member of an Axis of Evil in the January, 2002, State of the Union Address, North Korea has been on somewhat of a crusade to ensure other countries establish their own nuclear weapons programs. Specifically, it is alleged that North Korea helped establish nuclear weapons programs in both Iran and Syria.⁵

Another troubling aspect of this issue is the budding strategic relationship between Russia and Iran. There are growing indications that Russia and Iran have formed a very strong strategic alliance, based on their mutual hatred of the U.S. Other contributing factors for the creation of the alliance may be the Russian need for Iranian oil and Russian feelings of disempowerment by the rise of U.S. global military dominance. Iran is allegedly receiving technological help from Russia in developing its nuclear weapons program, and in exchange Russia will gain a means to indirectly attack America once the Iranian nuclear weapons program is fully operational.⁶ If true, then once Iran has produced enough nuclear weapons it could launch ideologically motivated extremists on suicide missions against the U.S. homeland with some type of nuclear bombs or missiles. One could also expect to see Russia start to openly criticize Israel's handling of the Palestinian conflict at some point as part of this strategic alliance.

Al-Qaeda's war against the non-Arab world: The third factor fueling an era of persistent conflict is Al-Qaeda's war against the non-Arab world, which began with Al-Qaeda's terrorist attacks in the early 1990s. Since both the Palestinian conflict and nuclear proliferation issues involve the potential use of nuclear weapons, Al-Qaeda's war

against the non-Arab world can, for the time being anyway, be labeled a less strategically important issue than these other two issues. However, this could change in an instant if Al-Qaeda were to gain access to nuclear weapons. In fact, as recently as December 2007, Secretary of the Army Pete Geren stated that Al-Qaeda is still seeking weapons of mass destruction.⁷ With so much nuclear proliferation in Arab countries, it is likely that Al-Qaeda is also seeking nuclear weapons, not just chemical or biological weapons. Additionally, of the three types of weapons of mass destruction (chemical, biological, or nuclear), only nuclear weapons would allow Al-Qaeda to conduct a more devastating attack on the U.S. homeland than it achieved in September 2001.

If Al-Qaeda is successful in its current efforts to seize control of the Pakistan government and its associated nuclear weapons, or if Al-Qaeda is simply given nuclear weapons by a country such as Iran or North Korea, then the issue of the war with a nuclear-capable Al-Qaeda would clearly rise in level of strategic importance as it relates to the larger era of persistent conflict. Of course, once given nuclear weapons, Al-Qaeda would likely attempt an even larger and more spectacular attack on the U.S. homeland than its very successful September 11, 2001, airborne attack. In that attack, Al-Qaeda attempted to simultaneously kill the U.S. president and destroy the White House, the Pentagon, and the World Trade Center. One can surmise that a nuclear attack by Al-Qaeda would be just as audacious. A nuclear capable Al-Qaeda would also be a serious threat to U.S. Army forces attempting to battle Al-Qaeda forces on the ground.

Given access to nuclear weapons, Al-Qaeda would likely attempt a similarly spectacular attack against the U.S. homeland as it conducted in 2001. In one imagined scenario Al-Qaeda simultaneously fires nuclear tipped missiles from ships off U.S. coasts

at cities such as Washington, DC and others. In a similar scenario, except without missiles, Al-Qaeda simultaneously sails nuclear bomb-laden ships into west and east coast harbors and detonates them there, destroying major coastal cities. Clearly, Al-Qaeda must be defeated; preferably before it either overthrows the Pakistan government or gains nuclear bombs from a sympathetic nuclear capable country.

Near Peer Competitors -- Russia and China: Beyond the three previous issues fueling the era of persistent conflict, there also exists the issue of near peer competitors. Both Russia and China are considered to be near peer competitors of the U.S. Direct conflicts with either of these two countries between now and 2015 seems unlikely. By their current actions, both seem to have decided upon indirect approaches at attacking American global dominance. For instance, neither seems to be developing the kind of large air force capable of global power projection that could directly threaten U.S. global air dominance. As stated previously, Russia seems to have settled on a strategic alliance with Iran as its best means of eventually attacking the U.S. and overthrowing U.S. global dominance. China, on the other, seems to be planning to attack U.S. global dominance in a future conflict through the use of various niche technologies it is currently developing, technologies such as cyber hacking, and anti-satellite missiles, and electromagnetic bombs. While it is unlikely that either country will attack America directly between now and 2015, should the U.S. show significant political or military weakness at any time, it may be attacked.

Iraq and Afghanistan: Another factor acting as part of the era of persistent conflict involves the wars in Iraq and Afghanistan. Both are important to U.S. national strategic interests and both will likely continue for years. It is likely that U.S. combat

forces will still be operating on both countries in 2015 and it is possible that U.S. forces will remain in either country for decades, similar to how U.S. forces have remained in Germany, Italy, and South Korea for decades. Once the three major issues of the Palestinian conflict and Al-Qaeda's war against the non-Arab world are favorably resolved, then it is possible U.S. forces could be removed from Iraq and Afghanistan.

North Korea: A conventional ground war with North Korea is also possible between now and 2015. However, this seems highly unlikely. If the U.S. began to act as if it were going to invade North Korea, its dictator, Kim Jong Il, would initially threaten to use nuclear weapons against the invaders, but after realizing the futility of radiating his entire country would most likely back down, offering concessions in return for the U.S. not to attack North Korea. Concessions might take the form of greater openness with South Korea and the West, for example, as long as Kim believed he could remain in power.

After his country was labeled a member state in an axis of evil in 2002, and after watching how the U.S. aggressively acted to depose dictator Saddam Hussein in Iraq, indications are that Kim Jong Il has attempted to protect his dictatorship both by developing a North Korean nuclear weapons program and by building a loose anti-U.S. coalition of nuclear capable states. It is doubtful that Kim Jong Il is spreading nuclear technology with the hope that it will be used offensively to directly attack America. Rather, he is likely doing this as a defensive means of preventing himself from being overthrown. Even with nuclear weapons, it is still likely that North Korea will not attempt to be so bellicose as to provoke a U.S. invasion. Rather, North Korea will

continue its outward appearances of supporting an eventual peaceful reunification with south Korea, even if it has no intentions of ever doing so.

Israel and Palestine: The possibility exists that the Palestinian conflict will be the dominant conflict in 2015. Two scenarios can be imagined. First, if there has been no peaceful resolution to the Palestinian conflict by then, it is possible that U.S. combat forces could be deployed to Israel to aid the Israelis in defending their country from a conventional attack by an Iranian-Russian-Arab coalition. On the other hand, if a peaceful resolution is achieved, then U.S. forces could be deployed as part of a peacekeeping force to either Israel or the newly established country of Palestine. The predominant threat against U.S. combat forces would likely be fanatical Extremist Guerrilla Army groups such as Hezbollah, Fatah, or Hammas.

Iran: There is also the possibility that between now and 2015 U.S. combat forces will be deployed to Iran, either as part of an invasion force or as peacekeepers. The most likely threat against U.S. combat forces in Iran will be an Extremist Guerrilla Army made up of former Quds Force soldiers. Unlike the Iraq War, U.S. forces operating in Iran could expect to see little to no sectarian violence, since 89 percent of the population is Shi'a and only 9 percent is Sunni.⁸

Pakistan: At some point conventional U.S. ground forces could be deployed to Pakistan, either to conduct combat operations against Al-Qaeda or to help stabilize the country following a major change in government leadership.

Asia and Africa: Climate change and natural disasters often cause drought, flooding, or crop damage in African and Asian countries, which can easily lead to a shortage of food in already overpopulated societies. Sectarian or tribal conflicts may

erupt following these disasters. Additionally, aggressive, anti-Christian activities by extremist militias (some of which are state supported) in Asia and Africa will continue. Some may lead to a humanitarian crisis by 2015. Examples of locations where militant anti-Christian activities or ethnic cleansings have taken place since the Cold War include Aceh province on the island of Sumatra in the country of Indonesia and the Darfur region of western Sudan. Climate change and natural disasters, as well as anti-Christian activities and ethnic cleansing by extremist militias, could be a major concern by 2015, leading to U.S. military deployments to non-developed countries in Asia and Africa.

A New Threat Model – The Extremist Guerrilla Army

As historical events have unfolded since the end of the Cold War, a new military threat model has emerged, the Extremist Guerrilla Army. What makes an organization “extremist” is that it uses extremely violent methods to bring about political change and its participants do not shrink from terror or suicide actions. The Extremist Guerrilla Army will be the dominant threat model in 2015. As used here, the word “army” means a military style force which has been organized, equipped, and trained. The term does not mean that an organization must belong to a nation state.

Establishing and defining a threat model is important because it helps determine how to organize, equip, train, and sustain a military force. In addition, it aids in the process of developing written doctrine. After analyzing the various threat groups which have arisen since 1989, a pattern has emerged of a definitive threat model, one which the U.S. can use to prepare itself for the 2015 timeframe, when the first FCS BCTs become operational. Since 1989 the vast majority of threat groups which conducted effective asymmetric operations against conventional military forces were predominantly extremist

organizations, to include several operating in the Balkans in the 1990s, the Chechins, the Taliban, Al-Qaeda, Al-Qaeda in Iraq, Hamas, Fatah, and Hezbollah.

Operations by Hezbollah against Israel in the July-August, 2006, Lebanon War offer the best example of how a future Extremist Guerrilla Army could function in the 2015 timeframe. In that conflict Hezbollah was able to inflict significant damage to Israeli mechanized forces. At a December, 2007, speaking engagement even Secretary of the Army Geren recognized Hezbollah's achievements, noting that the organization was very successful at employed modern antitank missiles to defeat Israeli tanks.⁹ Previous to this, the use of modern antitank missiles was extremely rare, and the much less powerful rocket propelled grenade (RPG) was used almost exclusively to attack main battle tanks. Geren went on to say, "The success of Hezbollah has fueled the ambitions of like-minded groups once intimidated by the military might of the United States and our allies."¹⁰ Clearly Hezbollah's tactical successes offer a model for future groups hoping to take on more advanced militaries such as the U.S. Army, and certainly many groups will study Hezbollah's battlefield success in attempts to emulate it in future military conflicts. After analyzing elements central to the era of persistent conflict, enemy tactical successes since 1989, and Hezbollah actions against Israel in 2006, the following 12 tactics have been identified which will likely be used by the Extremist Guerrilla Army of 2015.

- 1) Infiltrate into the area undetected: Avoid being detected while moving to the place you will conduct the operation, so as not to be attacked by helicopters or other aircraft.

- 2) Fight defensively: Without tanks and armored vehicles you must fight defensively.
- 3) Stay hidden (camouflaged): By remaining hidden the enemy's infantry and armored vehicles will come very close to you, thereby taking away their range advantage.
- 4) Stay away from (negate) Western air power: Do not come out into the open where Western UAS can detect you and CAS can bomb you. This is a change from previous insurgent tactics. In the past, insurgent forces attempted to negate the enemy's air and artillery firepower by "hugging" the enemy closely, which prevented the employment of his air and artillery. This change in insurgent tactics was caused partially by the rise in the use of UAS and precision bombing. More importantly, the sparsely vegetated desert and urban terrain of the Middle East has necessitated this change.
- 5) Use low tech mortars and rockets as fire support: The insurgents do not have artillery, but can be just as effective with mortars and unguided rockets.
- 6) Kill tanks with modern ATGMs: A modern main battle tank can be killed by a small antitank guided missile (ATGM).
- 7) Attack aircraft with modern SAMs: A modern main jet aircraft can be killed by a small shoulder fired surface-to-air missile (SAM).
- 8) Use large IEDs to attack the enemy: Large IEDs can kill enemy dismounted personnel patrolling on foot or enemy vehicles, other than tanks.
- 9) Utilize free commercial imagery and UAS: Free internet imagery provides an imagery capability for operational planning. Use UAS for detailed targeting.
- 10) Use VBIEDs to attack moving targets, checkpoints, and entry points: VBIEDs are best used to attack VIPs in moving vehicles or military convoys. They can also be used to attack checkpoints and entry points to military bases or government facilities.
- 11) Information Operations (IO): Aggressively use the media as a weapon to get your message out. Attempt to portray your enemy as overly aggressive and insensitive to your culture. To win popular support, and to turn the enemy's population against its own military, use the media to publicize your big battlefield kills and the enemy's deaths.
- 12) Suicide tactical nuclear strikes: By 2015 nuclear proliferation may well lead to the availability of either small tactical "nukes" for extremist forces or at least

nuclear materials that can be used in dirty bombs. These weapons will be hidden inside vehicles.

Battlefield Principles – The Unchanging Nature of War

Many battlefield principles which apply today will also apply in 2015. These principles remain constant, regardless of the operational environment in which U.S. forces find themselves. For example, the principles of employing movement and maneuver in conjunction with fires is an enduring battlefield principle that will not change. Utilizing a combined arms approach to war and fighting jointly with other services is another. The Army will still need to maintain a balanced tactical force, consisting of light, mechanized, special operations, and specialized units. Additionally, the notion that units must be able to conduct operations along a full spectrum of military conflict will remain a vital principle.

One final debate is that since the operational environment changes so rapidly, how can one possibly know what it will be like in 2015? The answer to this dilemma is that as long as U.S. combat leaders maintain principles of adaptability and flexibility they will be able to quickly respond to the changing nature of war. These and other battlefield principles will not change between now and 2015.

Dawning of the Information Age

One prominent change that is taking place in the nature of warfare is the transition from the industrial age to the information age. In many respects this transition is already complete. Understanding this movement to the information age is another factor that will help us determine how best to organize, equip, train, and sustain our mechanized BCTs. Also known as the digital age, the information age refers to the current time period in

which we live. Unlike its predecessor, the industrial age, which was focused on the production of goods, the information age is focused on the production and manipulation of information.

In their book, *Envisioning Future warfare*, General Gordon R. Sullivan and Colonel James M. Dubik state that, “Information-based nations will equip and organize their armies differently than their industrial counterparts...” and that “...the dawning of the information age will fundamentally change the conduct of warfare – just as the industrial age did a century and a half ago.”¹¹ The authors also argue that while the machine was the model of the industrial age, the network is the new model for the information age.¹² This indicates that machines are the most important components of an industrial age army, and information networks are the most important components of an information age army. Another conclusion is that in the information age it is not nearly as important to have many different kinds of machines as it is to have many different kinds of information networks for creating (detecting), manipulating, and sharing combat information. This concept of the dawning information age would seem to fit nicely with plans for the FCS mechanized BCT, since FCS vehicles share a common platform, with numerous built-in information networks.

Likely 2015 Hot Spots

In 2015, the first FCS BCTs will become operational. Based on information discussed in this chapter, here are the 12 countries in which mechanized BCTs may be deployed at that time. One can reasonably expect FCS BCTs to eventually be operating in one or more of these countries.

- 1) Iraq: Expect combat operations as part of the Iraq War to still be ongoing in 2015.
- 2) Afghanistan: Expect combat operations as part of GWOT to still be ongoing in 2015.
- 3) Pakistan: Either the President may direct that conventional combat forces take part in operations against Al-Qaeda in northern Pakistan or else Al-Qaeda successes against the Pakistani government may dictate that U.S. conventional forces enter Pakistan to conduct either combat or peacekeeping operations.
- 4) Israel: U.S. conventional forces may be deployed to Israel to defend the country against imminent attack.
- 5) Palestine: U.S. conventional forces may be deployed to the newly established country of Palestine to conduct either stability operations among its rival extremist guerrilla armies or peacemaking operations.
- 6) Jordan: U.S. conventional forces may be deployed east of Israel to deter or defeat an attack against Israel by extremist forces intent on destroying Israel.
- 7) Saudi Arabia: U.S. conventional forces may be deployed east of Israel to deter or defeat an attack against Israel by extremist forces intent on destroying Israel.
- 8) Lebanon: U.S. conventional forces may be deployed north of Israel to deter or defeat an attack against Israel by extremist forces intent on destroying Israel.
- 9) Iran: U.S. conventional forces may be deployed to Iran as part of an invasion force.
- 10) Turkey: U.S. conventional forces may be deployed to Turkey to deter or defeat Russian forces moving to attack Israel, in support of an alliance with Iran.
- 11) Syria: U.S. conventional forces may be deployed to Syria as part of an invasion force or to deter or defeat an attack against Israel by extremist/Russian forces intent on destroying Israel.
- 12) North Korea: U.S. conventional forces may be deployed to North Korea as an invasion force or to conduct peacekeeping operations following reunification between North Korea and South Korea.

Effects of the 2015 Operational Environment on CAW Enabling Capabilities

The operational environment of 2015 will have an impact on the 13 combined arms enabling capabilities. Specifically, the potential for nuclear weapons to be used on the 2015 battlefield, the tactics employed by future extremist guerrilla armies, and the need for effective information age networks will all have an impact. The following section addresses how the 2015 operational environment will affect each of the 13 enabling capabilities.

Combined Arms Warfare Enabling Capabilities	
Enabling Capability	Impact of 2015 Operational Environment
1) On-The-Move-Communications	BCTs must stay connected to numerous information networks while on-the-move
2) Airborne Command & Control	Airborne command & control will facilitate ground maneuver in complex and difficult urban terrain
3) Close Air Support (CAS)	Fixed-wing CAS will need to fly at higher elevations to avoid spooking enemy fighters
4) Ground Based Indirect Fires	Fires units will need to stay highly dispersed to avoid attracting nuclear weapons strikes
5) CBRNE Protection	All vehicles will need to be electromagnetically hardened and possess air filtration systems
6) Ground LOC Sustainment	Route Clearance missions will need to be approached as combined arms operations
7) Ground Resupply	Ground Convoys will need to be approached as combined arms operations
8) Aerial Resupply	Aerial Resupply will become the predominant means by which BCTs are logistically supported
9) Night Fighting	A higher percentage of BCT operations will be conducted at night
10) Gap Crossing	Mechanized BCTs will require a Gap Crossing capability regardless of the operational environment
11) Vertical Flight Attack Aviation	Attack helicopters must be able to tie-in to multiple BCT information networks
12) Vertical Flight Lift Aviation	Lift helicopters must be able to tie-in to multiple BCT information networks
13) Information Operations	BCTs will require an Information Operations company to counter enemy heavy use of IO

Figure 10. How the 2015 Operational Environment will impact the 13 Combined Arms Enabling Capabilities

- 1) On-The-Move Communications: To successfully conduct information age warfare units will need to “stay connected” to numerous information networks at all times, especially when moving. The potential for nuclear weapons use against massed U.S. forces will drive units to stay widely dispersed on the battlefield. Information age warfare takes place at much greater speeds than warfare in the industrial age, which is also a reason for units to stay connected to intelligence and communications networks.
- 2) Airborne Command & Control: The complexity of combat operations in 2015 dictates that units possess a means to conduct airborne command and control. Commanders who have this capability can more quickly assess the battlefield situation and provide direction to their subordinate units. Of the 12 possible 2015 hot spots, all involve operations in complex urban terrain, an environment with numerous manmade obstacles to ground maneuver (narrow alley ways, etc.), and one in which airborne command and control would help greatly to facilitate effective maneuver. Airborne command and control also facilitates ground maneuver through complex and difficult urban terrain. This capability can also be achieved through the use of UAS.
- 3) Close Air Support (CAS): The enemy’s ability to hide and remain undetected when in visual or auditory range of U.S. aircraft will force CAS aircraft to operate from much higher altitudes. Only from these higher altitudes will CAS aircraft be able to operate without spooking the enemy and driving him back into hiding. This will necessitate improvements to current targeting optics on aircraft, which will have to be modified to provide the same quality of imagery from higher altitudes.
- 4) Ground Based Indirect Fires: Due to the potential for nuclear weapons to be used on the battlefield against massed forces, fires units become highly prized targets for enemy forces and will need to stay widely dispersed.
- 5) CBRNE Protection: Due to the potential for battlefield nuclear weapons use, all FCS vehicles will need their electronics to be electronically hardened in order to protect them against electromagnetic pulse. Additionally, FCS vehicles will need to possess strong air filtration systems capable of preventing radiated dust particles from entering the vehicle crew compartment and harming personnel.
- 6) Ground LOC Sustainment: Continued enemy use of IEDs and EFPs will force BCTs to approach route clearance missions as combined arms operations, simultaneously employing armored vehicles, attack helicopters, and CAS as part of the operation.

- 7) Ground Resupply: Increased enemy lethality and continued use of IEDs and EFPs will force BCTs to approach ground convoys as combined arms operations, simultaneously employing armored vehicles, attack helicopters, and CAS as part of the operation.
- 8) Aerial Resupply: Increased enemy lethality will force the U.S. to utilize aerial resupply as much as possible, thereby minimizing the number of ground convoys BCTs must conduct. Aerial resupply will become the predominant means by which BCTs are logistically supported.
- 9) Night Fighting: Increased enemy lethality (use of ATGMs and handheld SAMs) and daytime survivability against CAS will force BCTs to conduct higher percentages of their combat operations at night.
- 10) Gap Crossing: This enabling capability will not be impacted by any particular characteristics of the 2015 operational environment. Regardless of where BCT operations are conducted in 2015 the need for a gap crossing capability will continue.
- 11) Vertical Flight Attack Aviation: The dawning of the information age suggests that attack helicopters must be able to tie-in to multiple BCT information networks. It also suggests that platform centric (platform focused) aviation programs should be replaced with network centric programs which enable better detecting (information gathering), manipulating, and sharing of combat information. Just as FCS ground vehicles utilize a common chassis for multiple variants, a new helicopter development program should be undertaken which stresses the importance of utilizing a common platform chassis and commonality of parts between an attack helicopter (to replace the AH-64 Apache), a lift helicopter (to replace the UH-60 Blackhawk), and a UAS (to replace the BCT-level Fire Scout).
- 12) Vertical Flight Lift Aviation: The dawning of the information age suggests that lift helicopters too must be able to tie-in to multiple BCT information networks.
- 13) Information Operations (IO): The Extremist Guerrilla Army's heavy use of IO suggests that BCTs will require a dedicated, company size unit to conduct information operations.

¹Joint Chiefs of Staff, "Admiral Mike Mullen: Address to Command and General Staff College Students, Fort Leavenworth, Kansas, October 23, 2007," Online at <http://www.jcs.mil/chairman/speeches/071023Address_QA_CGSC.html> (accessed April 2, 2008).

²Caroline McGregor, "Eyewitness to History: Caroline McGregor talks to former Soviet Ambassador Yury Dubinin about his role in bringing an end to the Cold War," Edited by David Johnson, CDI Russian Weekly, April 30-May 13, 2004, Online at <<http://www.cdi.org/russia/304-4.cfm>> (accessed April 28, 2008).

³"1981: Israel bombs Baghdad nuclear reactor," *BBC On This Day: 7 June 1981*, Online at <http://news.bbc.co.uk/onthisday/hi/dates/stories/june/7/newsid_3014000/3014623.stm>, Copyright MMVIII (accessed April 29, 2008).

⁴A.Q. Khan's Network, *GlobalSecurity.org*, Online at <<http://www.globalsecurity.org/wmd/world/dprk/khan-dprk.htm>>, Copyright 2000-2008 GlobalSecurity.org. (accessed April 29, 2008).

⁵Jet Jaguar, "North Korea Transferred Nuclear Materials to Iran," *FreeRepublic.com*, Online at <<http://www.freerepublic.com/focus/f-news/1998304/posts>>, Copyright 2000-2008 John Robinson, FreeRepublic, LLC. (accessed April 29, 2008).

⁶George Koukeas, "Reinstatement of the Cold War: The Russian Iran Alliance," *Canada Free Press*, January 22, 2008, Online at <<http://www.canadafreepress.com/index.php/article/1504>> (accessed April 29, 2008).

⁷"Secretary: Army must be structured to deal with 'persistent conflict'," *Association of the United States Army – AUSA News*, January, 2008 Issue, J&S Publications, Inc., 19.

⁸Iran Demographics Profile 2007. *Index Mundi*. Online at <http://www.indexmundi.com/Iran/demographics_profile.html>, Information Source: CIA World Factbook (accessed April 29, 2008).

⁹"Secretary: Army must be structured to deal with 'persistent conflict'," 19.

¹⁰*Ibid.*

¹¹Grodon R. Sullivan and James M. Dubik, "War in the Information Age," *Envisioning Future warfare*, Fort Leavenworth, KS: U.S. Army Command & General Staff College Press, 1995, 43.

¹²*Ibid.*, 46-48.

CHAPTER 6

FCS BCT COMBINED ARMS CAPABILITIES

We have gotten into the fashion of talking of cavalry tactics, artillery tactics, and infantry tactics. This distinction is nothing but a mere abstraction. There is but one art, and that is the tactics of the combined arms.

Major Gerald Gilbert, Indian Army, 1907¹

In October 1999, the U.S. Army launched its Future Combat System program.²

Commonly referred to as “FCS”, it was the brainchild of General Eric Shinseki, then Chief of Staff of the Army. Since that time, the FCS program has become the Army’s premiere, multi-year, multi-billion dollar modernization and acquisition program, designed to transform the Army’s ground combat units by radically upgrading their warfighting capabilities. General Shinseki intended for the program to make units lighter in weight so that they would require less time to deploy (transport) to a military theater preceding the start of a conflict. The faster the U.S. could build up combat forces in a military theater, the quicker it could begin fighting; thereby decreasing the time an adversary had available to react to a buildup of U.S. forces. In the case of the February 1991 Gulf War, it took the U.S. Army almost six full months of transporting units to the Saudi Arabia desert before enough combat power had been established to start the war and ultimately liberate Kuwait. General Shinseki understood that in future wars the U.S. could not afford to spend six months building combat power in a far away land before its Army was ready to begin hostilities. He knew that if the Army was to remain relevant long into the 21st Century, then it would need to decrease the weight of its combat units in order to increase the speed at which they could deploy.

The main factor limiting the rapid deployment of current Army units is the weight of their combat vehicles, primarily the M1 tanks, M2 infantry fighting vehicles, and M109 Paladins. General Shinseki believed that by replacing this fleet of heavy weight combat vehicles with lighter ones, the Army could then deploy its combat units to a military theater much more quickly than it had in the past. The latest version of the M1 tank weighs over 68 tons and with armor add-ons an M2 weighs 36 tons.³ Due to their weight, the U.S. military can only move a very small number of these combat vehicles into a military theater by air. This situation necessitated the acquisition of lighter vehicles. forward basing and afloat basing are two other potential solutions to the problem of weight, but these ideas seem to have been abandoned.

Towards that end, the FCS program intends to design and produce a fleet of much lighter armored vehicles using new – some as yet unproven – concepts and technologies. The new FCS armored vehicles are scheduled to begin initial production as early as 2010. They will come in eight different variants, from tank to battlefield ambulance, and will replace the M1 tank, M2 and M3 infantry fighting vehicles, M113 infantry carrier, and the M109 Paladin 155mm self-propelled artillery system. By 2015 the Army plans to have fielded its first BCT fully equipped with FCS vehicles.⁴

Components of the Future Combat System (FCS)

The FCS program is made up of five core systems, including: 1) manned ground vehicles (MGVs), which come in eight different variants while sharing a common chassis, 2) unmanned aerial systems (UASs), consisting of the Class I (platoon-level) and Class IV (brigade-level) aircraft, 3) unattended ground systems (UGSs), which include two types of unattended ground sensors and the non-line of sight launch system (NLOS-

LS), 4) the unmanned ground vehicles (UGVs), comprised of one small, platoon level UGV and three large, six-wheeled UGVs, and 5) a central information network called the system-of-systems common operating environment (SOSCOE). Figure 11 depicts the five core systems of the FCS program (MGVs, UASs, UGSs, UGVs, and SOSCOE). Also noteworthy in Figure 11 is the number of soldiers depicted manning each of the eight FCS manned ground vehicle variants.

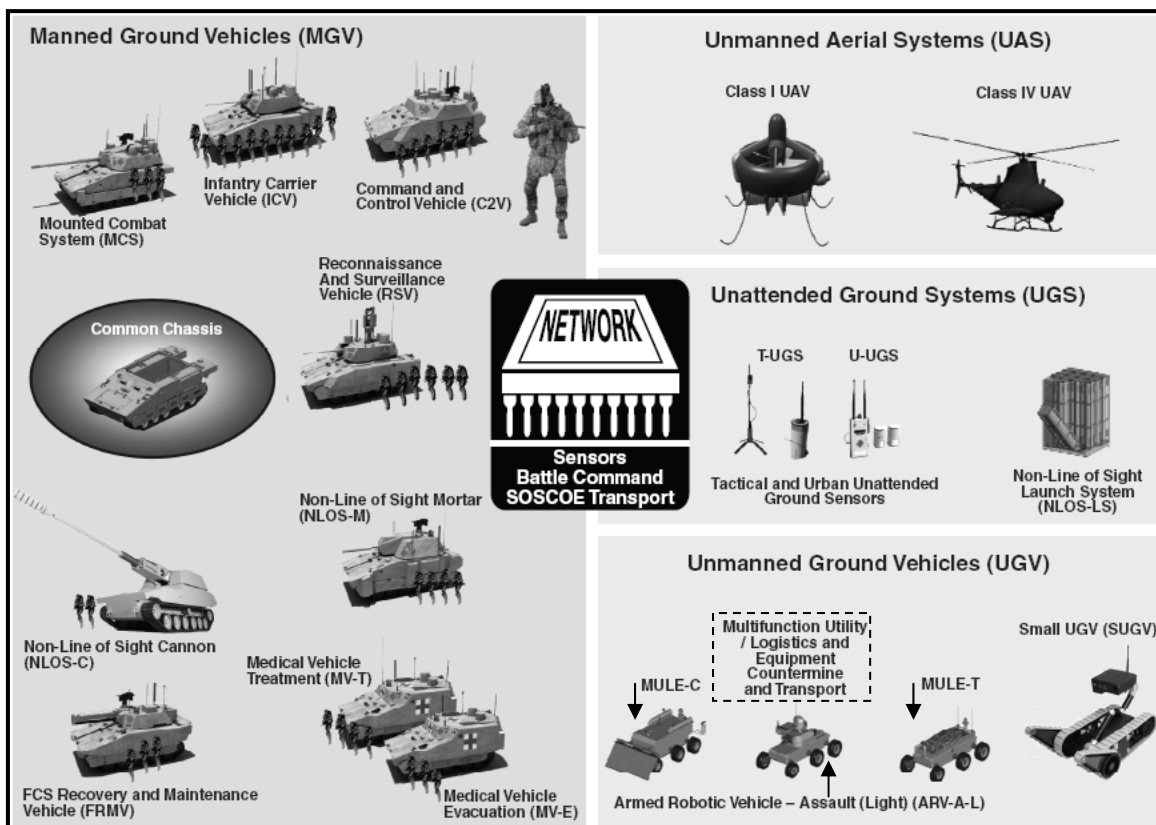


Figure 11. FCS Core Systems⁵

Proposed FCS BCT Structure

There have been numerous proposals concerning how an FCS BCT should be structured. However, at this point there is no officially approved unit structure. Figure 12 shows one possible FCS BCT organizational structure, based on numerous charts which have been unofficially passed around the Army by various Army branches as they begin to think through how their branch might support this new type of mechanized BCT.

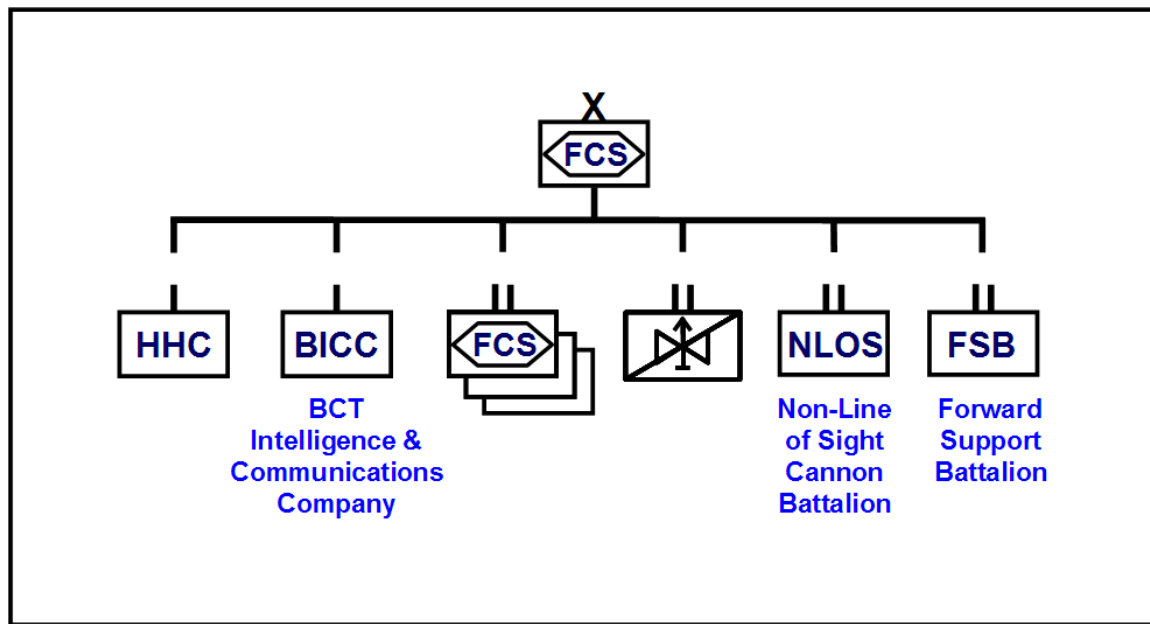


Figure 12. Possible FCS BCT Unit Structure⁶

The FCS BCT depicted here has three combined arms battalions. Each battalion will have three combined arms companies and its own organic 4.2 inch Non-Line of Sight Mortar (NLOS-M) platoon of six vehicles. There are a total of 23 infantry squads in each battalion.⁷ Unlike current BCTs, the FCS BCT will not have both a brigade support battalion (BSB) and a brigade special troops battalion (BSTB). Instead, it will have a single forward support battalion (FSB). This is due to the large change in tooth-

to-tail ratio of soldiers that FCS is expected to achieve. With all manned combat vehicle variants utilizing the same common chassis, there will be a significant reduction in the need for maintenance personnel within the BCT, reducing the overall number of support soldiers needed. The FSB will likely include maintenance, ammunition, transportation, and supply distribution companies. In addition, some elements normally held at brigade level, such as engineers, will no longer be needed now that each FCS combined arms battalion has its own set of MULE-C (Countermine) unmanned ground vehicles.

Together, the artillery battalion and aviation reconnaissance squadron will add tremendous firepower to the unit. The Non-Line of Sight Cannon (NLOS-C) battalion will most likely consist of three batteries of self-propelled 155mm NLOS-C vehicles, a fire direction battery, and a fire finder radar battery. The three NLOS-C batteries can either remain consolidated at the brigade level, or else be pushed down in a direct support (DS) role, one battery for each combined arms battalion. It is unknown how many NLOS-C vehicles there will be in each NLOS-C battery, but estimates are either six or eight. It still has to be decided whether or not the BCT will have an aviation reconnaissance squadron. If it does, then expect to see one AH-64 Apache troop of eight aircraft, one OH-58 Kiowa troop of eight aircraft, and one troop of eight Fire Scout UASs. If the Army decides not to include Apaches in the squadron, then it is possible that the squadron could have only one Kiowa troop and one Fire Scout troop.

The headquarters company (HHC) and battlefield intelligence and communications company (BICC) are also part of the FCS BCT. Within the HHC one can expect to find the same brigade level staff functions that other BCTs possess. Of note is that a BCT's headquarters company normally includes an attached four-person

civil affairs (CA) team and an attached four to eight person psychological operations (PSYOP) team. The CA team advises the BCT commander on all civil-military issues, conducts civil-military planning, and may also run a BCT level civil military operations center (CMOC). The PSYOP team will normally bring with it two tactical vehicles and vehicle mounted loudspeakers, which can be used to either broadcast announcements in the local language or to produce military-related noises as part of deception operations.

Manned Ground Vehicle Variant Shortfalls

The FCS BCT, as outlined in this chapter, is a very capable combined arms organization. Its mix of infantry squads, light tanks (the MCS vehicles), mobile indirect fire systems (4.2 inch mortar and 155mm artillery), reconnaissance vehicles, and armed helicopters makes it a formidable force. Its use of a common vehicle platform weighing less than current vehicles also offers great advantage, as this should enable greater mobility for the BCT as a whole.

However, there are several obvious deficiencies with regard to the manned ground vehicle variants. First, there is no dedicated air defense variant, which will likely result in air defense personnel having to ride in the back of an infantry carrier vehicle and then exit the vehicle to engage aircraft with shoulder fired anti-aircraft weapons. While this approach still maintains an air defense capability, it is certainly not as efficient or effective as having a dedicated air defense variant, from which air defense soldiers can engage aircraft with either guns or missiles while under armor.

Second, there is no indirect fires variant being planned which is capable of firing long-range rockets. This variant would be similar to the Army's current M270 multiple launch rocket system (MLRS). Each BCT should have at least one battery of rocket

firing systems. Even if they are not to be maintained at the BCT level, replacing all current M270s with a new, similar system based on an FCS manned ground vehicle chassis is a wise decision in the long-term from logistics and maintenance perspectives.

Third, there are no dedicated engineer variants of the manned ground vehicle. At the very least there needs to be a bridge layer variant to conduct gap crossings. This variant would be capable of carrying a heavy assault bridge similar to the one carried by the M104 Wolverine bridge layer.

FCS BCT Capability Gaps

Beyond these three deficiencies in manned vehicle variants (air defense, rocket firing, and engineer), it is important to examine how the FCS BCT stacks up against the combined arms enabling capabilities outlined in this study. More specifically, this study seeks to bring to light capability gaps between the unit's planned capabilities versus those expected to be needed in the operational environment of 2015. Of the 13 combined arms enabling capabilities discussed in this study, five are capability gaps for the FCS BCT. Each of these five capability gaps are addressed below and depicted in Figure 13.

On-The-Move Communications: In 2015, units will need to stay connected to various information networks (both voice and data) via satellite communications, while on the move. To do this, all manned vehicles in FCS BCTs will require the installation of roof mounted, ruggedized SATCOM antennas capable of continuously pointing to the area of the sky in which the satellite is located. Without this type of antenna FCS vehicles will not have true on-the-move capability.

CBRNE Protection: There is increased potential for mechanized units to be operating on a nuclear battlefield in 2015. As such, all FCS manned ground vehicle electronics will need to be electromagnetically hardened to withstand such an environment. Additionally, to prevent the ingestion of airborne, radiologically contaminated particles by soldiers riding inside FCS vehicles, all FCS manned ground vehicles will require robust air filtration systems.

FCS BCT Capability Gaps	
Enabling Capability - 2015	FCS BCT Capability Gap
1) On-The-Move-Communications FCS vehicles must stay connected to numerous information networks while on-the-move	FCS vehicles require the installation of ruggedized SATCOM antennas to stay connected to numerous information networks while on-the-move
2) CBRNE Protection All vehicles will need to be electromagnetically hardened and possess air filtration systems	FCS manned ground vehicles require "hardened" electronics and robust air filtration systems
3) Ground LOC Sustainment Route Clearance missions will need to be approached as combined arms operations	FCS needs either a manned engineer vehicle variant to do Route Clearance or else the six wheeled countermine UGV should be converted to a tracked vehicle and specialized route clearance equipment added
4) Gap Crossing Mechanized BCTs will require a Gap Crossing capability regardless of the operational environment	Create an FCS bride layer variant capable of carrying a heavy assault bridge similar to the one carried by the M104 Wolverine
5) Information Operations BCTs will require an Information Operations company to counter enemy heavy use of IO	Establish an IO company at the BCT level to counter the enemy's heavy use of IO

Figure 13. Capability Gaps of the Future FCS BCT

Ground LOC Sustainment: The ability of a unit to conduct route clearance relies heavily on its use of specialized engineer vehicles to approach and remove roadside IEDs, mines, and other route hazards. Other than the one FCS unmanned ground vehicle (UGV) variant dedicated to countermine operations, there are no other engineer variants.

This means that units will have to continue to rely on wheeled Mine-Resistant Ambush Protected (MRAP) vehicles for route clearance. These MRAPs work well in a steady-state COIN environment, but it is unlikely they will survive in an MCO environment. The FCS BCT needs either a manned engineer variant to do the route clearance mission or else the planned six wheeled countermine UGV should be converted to a tracked vehicle and specialized route clearance equipment be added to it. For example, the addition of a long, extendable arm that can be used to disarm IEDs may be warranted.

Gap Crossing: There is no bridge layer variant within the planned manned ground vehicles. The FCS BCT, like other mechanized BCTs, requires a gap crossing capability. Not having this capability will restrict the unit's mobility unnecessarily. A bridge layer variant should be capable of carrying a heavy assault bridge similar to the one carried by the M104 Wolverine bridge layer.

Information Operations (IO): The heavy expected use of IO by extremist guerrilla armies in 2015 necessitates a large role for IO in the FCS BCT. However, only a small PSYOP section is planned. In addition, the Army now doctrinally lumps five different functions together under the heading of IO (electronic warfare, computer network operations, psychological operations, military deception, and operations security). Taken together, managing these five functions will require a significant amount of manpower. An IO company will be required to counter the enemy's heavy use of IO.

¹Gerald Gilbert, *The Evolution of Tactics*, London, UK: Hugh Rees, 1907, 183-184.

²Andrew Feickert, "The Army's Future Combat System (FCS): Background and Issues for Congress," *Congressional Research Service (CRS) Report for Congress*,

Online at <http://www.ndu.edu/library/docs/crs/crs_r132888_28apr05.pdf>, April 28, 2005, p CRS-1 (accessed April 30, 2008).

³U.S. Army, “Weapons Systems 2007-2008,” Online at <<http://www.fas.org/man/dod-101/sys/land/wsh2007/62.pdf>> (accessed April 30, 2008).

⁴Program Manager, FCS Brigade Combat Team (2007), “FCS White Paper,” Online at <<http://www.army.mil/fcs/whitepaper/FCSwhitepaper07.pdf>>, p 4, (accessed November 1, 2007).

⁵FCS Core Systems diagram information was taken from a U.S. Government Accounting Office report titled “Defense Acquisitions: 2009 Is a Critical Juncture for the Army’s Future Combat System,” GAO-08-408 Defense Acquisitions, *GAO Report to Congressional Committees*, March, 2008, 6.

⁶Proposed FCS BCT structure taken from briefing charts titled, “Current Force and Future Force: Military Intelligence Overview 2007 and Beyond,” June 11, 2007.

⁷Army Capabilities Integration Center (ARCIC), “Delivering Future Combat Systems Brigade Combat Teams” digital brochure, 22 February 2008, Online at <https://www.fcs.army.mil/downloads/pdf/FCS_BCT_Outcomes.pdf> (accessed April 29, 2008).

CHAPTER 7

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

We still fail to use every weapon every time . . . Each time we fight with only one weapon when we could make use of several weapons, we are not winning a battle, we are making fools of ourselves.

George S. Patton¹

This study had two purposes. First, through the use of historical examples wherever possible, it strove to develop and explain the concept of combined arms enabling capabilities. Simply put, these are capabilities which enable combined arms operations. More to the point, they are capabilities that all BCTs need in order to conduct effective combined arms operations in the challenging operational environment expected in 2015, when the first FCS BCT will become operational. Second, the study sought to identify potential FCS BCT capability gaps and make recommendations as to how best to assuage these deficiencies. The study developed and explained 13 combined arms enabling capabilities for mechanized BCTs, identified five critical FCS BCT capability gaps, and will recommend, later in this chapter, five potential solutions that can be implemented to mitigate these capability gaps.

Thesis Summary

This study consists of seven chapters. Chapter 1 served as the document's introduction. In this chapter the author identified the primary problem to be solved as whether or not FCS equipped BCTs would possess significant combined arms capability gaps when the first FCS BCT was becoming operational in 2015. Several assumptions were made by the author; first among these is that combined arms enabling capabilities

exist which can be identified through historical analysis. The author narrowed the scope of the study to selected historical developments in combined arms warfare (CAW) which illustrate combined arms enabling capabilities, focusing primarily on technological and doctrinal changes to mechanized combined arms capable brigade level units. It was also established that the primary focus of study would be the FCS equipped mechanized BCT, as opposed to Infantry BCTs (IBCTs). The author highlighted that the significance of the research was to further the Army's understanding of the combined arms method of war through identification of combined arms enabling capabilities. The author also acknowledged their potential for attendant changes to organizational structure (force design), technology or doctrine, as well as their value to Army leaders in making final capability decisions for the FCS program. Finally, the study's research methodology was identified, establishing that it contained components of a program evaluation (of the FCS program) combined with a heavy emphasis on reviewing existing historical data on combined arms operations.

Chapter 2 explored the nature of CAW, and through the use of synchronization theory explained how synchronization is the key process by which units are able to plan for and conduct the simultaneous employment of a combination of arms on the battlefield, thereby benefiting from their synergistic effects. A model of traits and processes was introduced to establish a theoretical framework from which to describe CAW. Utilizing this theoretical model, the author described CAW as both a set of capabilities that combined arms units must possess and a set of procedures they must execute in order to conduct effective combined arms operations on the modern battlefield. A short list of potential CAW procedures was offered, procedures which

could easily be further developed into individual, team, and collective tasks to be trained and taught at Army service academies, branch schools, and combat training centers.

The author used Chapter 3 to review main developments of mechanized CAW from World War I to the present Iraq War, including World War II, Korea, Vietnam, and the Gulf War. The chapter focused on major developments in the areas of combined arms concepts, organizations, and tactics. Issues such as the role of ground attack aircraft as part of blitzkrieg tactics, the employment of American tank destroyers, and the development of U.S. air envelopment tactics were covered. This chapter also set the stage for Chapter 4, which detailed the 13 combined arms enabling capabilities that modern mechanized BCTs need to be successful on the modern battlefield.

The author's 13 combined arms enabling capabilities were discussed in Chapter 4. The combined arms approach to war was explained, noting that in CAW not only does a unit simply employ various arms in a supporting and complimentary manner, but that it is also simultaneously employing enabling capabilities when conducting combat operations. A unit's potential for battlefield success was linked to the possession and employment of enabling capabilities. The idea that the 13 enabling capabilities did not necessarily have to be organic to a unit was also mentioned. If these capabilities are not organic, then the unit's higher headquarters will need to provide them when required. The author finished by arguing for a greater awareness on the part of Army officers of the importance played by the 13 enabling capabilities.

Chapter 5 speculated on how the operational environment might look in 2015, since this is when the first FCS equipped BCT becomes fully operational. Additionally, it examined the effects of the 2015 operational environment against the 13 combined

arms enabling capabilities. The author concluded that a new military threat model, the Extremist Guerrilla Army, would be the dominant threat model in 2015. The need for the U.S. Army to settle on a definitive post-Cold War threat model was also argued, understanding that having a credible threat model helps determine how to best organize, equip, train, and sustain U.S. combat forces.

Finally, Chapter 6 described the FCS program, examining the organic combined arms enabling capabilities that FCS BCTs will possess. The author identified five key capability gaps after analyzing the enabling capabilities that FCS equipped BCTs are programmed to have, versus the 13 that the author maintains are critical to all BCTs. These five capability gaps have to do with: 1) a need for better on-the-move communications, 2) protection from nuclear contamination, 3) specialized engineer vehicles for route clearance, 4) an assault bridge variant of the FCS armored vehicle, and 5) a larger information operations (IO) presence within the unit.

Thesis Conclusions

This study arrived at seven findings. The first involves the notion that CAW is a unique method of warfare. The second finding concerns the notion of the Extremist Guerrilla Army as a new post-Cold War threat model, an idea that could become the basis for new Army doctrine. The final five findings involve areas in which FCS will not be fully capable in the dynamic operational environment of 2015.

Finding 1: Combined Arms Warfare is a “Method” of Conducting Warfare

In Chapter 2 the author showed that CAW is in reality a method of conducting warfare, one which has a direct relationship (linkage) between the Army’s wartime

mission and its wartime endstate. The three components of a wartime endstate are:

1) the enemy; 2) the terrain (specifically, an Army's ability to freely maneuver across it); and 3) the civilian populace. A method of warfare should not be linked doctrinally to a specific threat model, since this will only result in a short lived, overly threat-focused method of warfare that will only perpetuate a cycle of preparing for the last war.

Additionally, no single threat is likely to be sufficiently broad to encompass the entire spectrum of military conflict. Instead, doctrinally linking a method of warfare to a broad ranging, wartime endstate is best, and ensures that the Army will focus its efforts on developing combat capabilities across the full spectrum of military conflict.

Finding 2: Extremist Guerrilla Army as Post-Cold War Threat Model

A definitive military threat model has emerged since the end of the Cold War. This thesis calls it the Extremist Guerrilla Army, and it will be the dominant world threat model by 2015. Since 1989 the vast majority of threat groups capable of conducting effective asymmetric operations against conventional military forces have been predominantly extremist, to include those operating in the Balkans in the 1990s, the Chechins, the Taliban, Al-Qaeda, Al-Qaeda in Iraq, Hamas, Fatah, and Hezbollah. Operations by Hezbollah against Israel in the July-August, 2006 Lebanon conflict offer the best example of how a future Extremist Guerrilla Army would operate in the 2015 timeframe. In the 2006 conflict Hezbollah was able to inflict significant damage to Israeli mechanized forces. Hezbollah has developed numerous tactics to successfully negate Israel conventional strengths. It is expected that these tactics will be widely copied by other groups between now and 2015.

Finding 3: FCS Does Not Have True On-The-Move Capability

One area in which FCS will not be fully capable in the dynamic operational environment of 2015 involves the enabling capability of on-the-move communications. By 2015 FCS units will need to stay connected to various information networks (both voice and data) via satellite communications, while on-the-move. Units cannot do this currently, due to the lack of a ruggedized SATCOM antenna for all FCS vehicles. Currently, BCTs have SATCOM radios, but these do not allow a true on-the-move capability, as units have to stop, set up a SATCOM antenna and position the antenna facing towards the correct area of the sky. This process forces units to halt and soldiers to dismount their vehicles.

Finding 4: FCS BCTs Will Likely Operate on a Nuclear Battlefield

Due to ongoing Middle Eastern and Asian nuclear proliferation, there is increased potential for mechanized units to be operating on a nuclear battlefield in 2015. This environment may include fission or fusion weapon detonations, as well as those caused by enhanced radiation/dirty bombs.

Finding 5: FCS BCTs Lack Engineer Variants for Ground LOC Sustainment

The ability of a unit to conduct route clearance relies heavily on its use of specialized engineer vehicles to approach and remove roadside IEDs, mines, and other route hazards. Other than the one FCS unmanned ground vehicle (UGV) variant dedicated to countermine operations, there are no other engineer variants. This means that FCS units will have to continue to rely on wheeled Mine-Resistant Ambush

Protected (MRAP) vehicles for route clearance. These MRAPs work well in a steady-state COIN environment, but it is unlikely they will survive in an MCO environment.

Finding 6: FCS BCTs Lack Gap Crossing Capability

There is no FCS bridge layer vehicle variant within the planned manned ground vehicle types. The FCS BCT, like other mechanized BCTs, requires a gap crossing capability. Not having this capability will restrict the unit's mobility unnecessarily. A bridge layer variant would need to be capable of carrying a heavy assault bridge similar to the one carried by the M104 Wolverine bridge layer.

Finding 7: Enemy Forces Will Conduct Heavy Use of IO

It is expected that extremist guerrilla armies in 2015 will employ heavy use of IO. However, in the planned FCS BCT structure there is only a small PSYOP section in the BCT HHC that is capable of planning and coordinating information operations. In addition, the Army now doctrinally lumps five different functions together under the heading of IO (electronic warfare, computer network operations, psychological operations, military deception, and operations security). Taken together, managing these five functions will require a significant amount of manpower.

Thesis Recommendations

This study makes seven recommendations. The first seeks to elevate the status of CAW to a much higher level of importance within the Army. The second promotes the idea that the Extremist Guerrilla Army should be adopted by TRADOC as a new post-Cold War threat model. The final five are recommendations for mitigating potential

capability gaps in areas which the FCS BCT, as currently planned, will not be fully capable in the dynamic operational environment of 2015.

Recommendation 1: Doctrinally Establish CAW as a Method of Warfare

In line with Finding 1, this study recommends that FM 3-0, *Operations*, be modified to identify CAW as the Army's primary method of conducting warfare. It should be clearly spelled out that this method of war offers a noticeable advantage over an adversary force that cannot conduct this method of warfare. This new doctrine should stress that an Army which can best synchronize its individual arms through the combined arms method has a marked advantage in war. Examples of what this "new" doctrine could be called include Integrated Combat or simply Combined Arms Warfare.

Whatever the name, it should become the Army's core doctrine guiding the development of Army Transformation in general and the FCS program in particular. This new doctrine could help transform the Army into a more capable and decisive land combat force, as well as provide the doctrinal foundation for the FCS program – similar to how AirLand Battle served as the foundational doctrine for the Army prior to the Gulf War. It will need to emphasize speed in decision making, synchronizing of different military arms, and close integration of manned and unmanned systems.

Recommendation 2: Doctrinally Establish Extremist Guerrilla Army Threat Model

Based on Finding 2, the U.S. Army's Training and Doctrine Command should formally accept the Extremist Guerrilla Army as the primary threat model that Army forces will be facing through at least the 2015 timeframe. The Extremist Guerrilla Army threat model will be the dominant world threat model by 2015. Operations by Hezbollah

against Israel in the July-August 2006 Lebanon War offer the best examples of how extremist guerrilla armies will operate. It is expected that Hezbollah's tactics in that conflict will be widely copied by other groups between now and 2015. Just as the Army produced a manual during the Cold War that explained in detail how the Soviet Army intended to fight on the battlefield, so too should the Army produce a manual on the Extremist Guerrilla Army. This manual would help drive the Army's future training, doctrine writing, and other processes

Recommendation 3: FCS Vehicles Need Ruggedized SATCOM Antennas

Based on Finding 3, ruggedized SATCOM antennas need to be fielded for all FCS vehicles. The antennas should be mounted on top of all FCS vehicles. Only ruggedized SATCOM antennas will allow units to stay connected to the various FCS information networks (both voice and data) while on the move.

Recommendation 4: Prepare FCS BCTs for a Nuclear Battlefield

Based on Finding 4, all FCS manned ground vehicles (MGVs) will need to be protected from the harmful effects of both nuclear bombs and enhanced radiation/dirty bombs. With regard to the enabling capability of CBRNE Protection, harden all FCS vehicle electronics against electromagnetic attack so that they will be able to operate in a nuclear environment. Additionally, robust air filtration systems must be installed on all FCS MGVs, to prevent the exposure to and ingestion of airborne, radiologically contaminated particles by soldiers riding inside these vehicles.

Recommendation 5: Create an FCS Manned Engineer Vehicle Variant

Based on Finding 5, create a manned engineer variant to do the route clearance mission. Specialized route clearance equipment may need to be added to the vehicle. For example, the addition of a long, extendable arm that can aid in rendering safe roadside IEDs may be warranted.

Recommendation 6: Create an FCS Manned Bridge Layer Vehicle Variant

Based on Finding 6, an FCS manned bridge layer vehicle variant must be produced to ensure the FCS BCT maintains its freedom to maneuver on the battlefield. This will give the FCS BCT a gap crossing capability. A bridge layer variant will need to be capable of carrying and emplacing a heavy assault bridge similar to the type carried by the M104 Wolverine bridge layer.

Recommendation 7: Establish an IO Company at the FCS BCT Level

Based on Finding 7, there needs to be an IO company at the BCT level. This unit will be able to counter the enemy's heavy use of IO. In addition, it will manage the five different IO functions (electronic warfare, computer network operations, psychological operations, military deception, and operations security). Taken altogether, managing these five functions will require an IO company. A concern that some may have when considering the implementation of this recommendation is that many soldiers in today's IO and PSYOP communities are trained to be either regional specific or language specific. The easiest way to overcome this concern is to simply create regionally aligned battalions consisting of five or six IO companies. This is how many civil affairs (CA) and PSYOP units are organized today.

¹Ryan, Alan, “Combined Arms Cooperation in the Assault: Historical and Contemporary Perspectives,” In *Land Warfare Studies Centre (LWSC) Working Papers No. 122, From Breitenfeld to Baghdad: Perspectives on Combined Arms Warfare* - pp 53-63, Edited by Michael Evans and Alan Ryan. Duntroon, AUS: Land Warfare Studies Centre, July, 2003, 63.

GLOSSARY

Combined Arms Enabling Capability. Those capabilities that enable combined arms operations. Capabilities most critical for units to possess if they are to conduct effective combined arms operations in the challenging operational environment of 2015. For example, in order to conduct a mechanized combined arms attack, units must be able to communicate while moving forward on the battlefield. Therefore, communicating on the move is a combined arms enabling capability.

Combined Arms Warfare (CAW). A method of warfare that seeks to closely integrate different military arms to achieve mutually complementary effects. Through employing a combination (two or more) of arms together at the same time on the battlefield, ground units are able to benefit from the synergistic effects of these arms. Arms are understood to be combat arms branches of the Army (infantry, armor, field artillery, aviation, engineers, air defense artillery, or special operations forces) or any of the six U.S. Army doctrinal warfighting functions (movement and maneuver, fires, intelligence, sustainment, command and control, protection). Combined Arms Warfare can be broken down into its three main components: 1) combined arms concepts; 2) combined arms organization; and 3) combined arms tactics (also called combined arms operations).

Operational Environment (OE). A composite of all conditions, circumstances, and influences affecting the employment of military forces or capabilities that bear on the decisions of the unit commander. The operational environment includes conventional and unconventional threats.

BIBLIOGRAPHY

Books

- Bellman, Richard. "Mathematical Aspects of the Theory of Systems." In the book titled *Proceedings of the Symposium on System Theory: New York - 1965*. Edited by Jerome Fox. Brooklyn, New York: Polytechnic Press of the Polytechnic Institute of Brooklyn, 1965.
- Bidwell, Shelford and Dominick Graham. *Fire-Power: The British Army Weapons & Theories of War 1904-1945*. S. Yorkshire, UK: Pen & Sword Book Limited, 2004.
- Brodie, Bernard and Fawn M. *From Crossbow to H-Bomb: The Evolution of the Weapons and Tactics of Warfare*. Bloomington & Indianapolis, Indiana: Indiana University Press, 1973.
- Chandler, David. *Napoleon*. London, UK: Weidenfeld & Nicholson, 1973.
- Chappell, Mike. *The British Army in World War I (2): The Western Front 1916-1918*. Oxford, UK: Osprey Publishing, 2005.
- Citino, Robert M. *Blitzkrieg to Desert Storm: The Evolution of Operational Warfare*. Lawrence, KS: University Press of Kansas, 2004.
- Doubler, Michael D. *Closing with the enemy: How GIs Fought the War in Europe, 1944-1945*. Lawrence, KS: University Press of Kansas, 1994.
- Gabel, Christopher R. *Seek, Strike, and Destroy: U.S. Army Tank Destroyer Doctrine in World War II*. Leavenworth Papers No. 12. U.S. Army Command and General Staff College. Fort Leavenworth, KS: USACGSC, September, 1985.
- Galvin, John R. *Air Assault: The Development of Airmobile Warfare*. New York, NY: Hawthorn Books, Inc., 1969.
- Gilbert, Gerald. *The Evolution of Tactics*. London, UK: Hugh Rees, 1907.
- Gilbert, Martin. *The First World War: A Complete History*. New York, NY: Henry Holt and Company, 1994.
- Glanfield, John. *The Devil's Chariots: The Birth & Secret Battles of the First Tanks*. Gloucestershire, UK: Sutton Publishing Limited, 2001.
- Heinl, Robert D. *Soldiers of the Sea: The United States Marine Corps, 1775-1962*. Annapolis, MD: United States Naval Institute Press, 1962.

- House, Jonathan M. *Toward Combined Arms Warfare: A Survey of 20th-Century Tactics, Doctrine, and Organization*. Fort Leavenworth, KS: Combat Studies Institute, U.S. Army Command & General Staff College Press, 1984.
- Jager, Herbert. *German Artillery of World War One*. Wiltshire, UK: The Crowood Press Ltd, 2001.
- Keegan, John. *An Illustrated History of The First World War*. New York, NY: Alfred A. Knopf, 2001.
- Melcher, Arlyn J. "Theory and Application of Systems Theory: Its Promises, Problems, and Realizations." In *General Systems and Organization Theory: Methodological Aspects*. Edited by Arlyn J. Melcher. Kent, Ohio: Kent State University, Center for Business and Economic Research, 1975.
- Messenger, Charles. *The Blitzkrieg Story*. New York, NY: Charles Scribner's Sons, 1976.
- Miksche, Ferdinand O. *Attack: A Study of Blitzkrieg Tactics*. New York, NY: Random House, 1942.
- Pierce, Terry C. *Warfighting and Disruptive Technologies: Disguising Innovation*. New York, NY: Frank Cass, 2004.
- Van Creveld, Martin. *The Changing Face of War: Lessons of Combat From the Marne to Iraq*. New York, NY: Presidio Press, 2006.
- Wenninger, Eugene P. "Entropy, Equilibrium, and Organizations: Problems of Conceptualization." In *General Systems and Organization Theory: Methodological Aspects*. Edited by Arlyn J. Melcher. Kent, Ohio: Kent State University, Center for Business and Economic Research, 1975.
- Roxin, Emilo. "Dynamical Systems With Inputs." In the book titled *Proceedings of the Symposium on System Theory: New York - 1965*. Edited by Jerome Fox. Brooklyn, NY: Polytechnic Press of the Polytechnic Institute of Brooklyn, 1965.
- Sullivan, Grodon R. and James M. Dubik. "War in the Information Age." *Envisioning Future warfare*. Fort Leavenworth, KS: U.S. Army Command & General Staff College Press, 1995.

Periodicals

- Beevor, Antony. "Stalingrad: The Most Pitiless Battle in Modern History." *World War 2: 2,194 Days That Changed Everything – World War II Magazine Special Collector's Edition*. Leesburg, VA: Weider History Group, Inc., 2007, 32-39.
- Biddle, Stephen. "The Past as Prologue: Assessing Theories of Future War." *Security Studies*. Autumn 1998, vol. 8, no. 1.

- Friedman, George. "Beyond Fourth Generation Warfare." *The Officer: Reserve Officers Association National Security Report* (September 2007), 57-60.
- Hall, Robert and Andrew Ross. "Lessons from Vietnam: Combined Arms Assault against Prepared Defences." In *Land Warfare Studies Centre (LWSC) Working Papers No. 122, From Breitenfeld to Baghdad: Perspectives on Combined Arms Warfare - 27-52*. Edited by Michael Evans and Alan Ryan. Duntroon, AUS: Land Warfare Studies Centre, July, 2003.
- Harvey, David S. "ODIN Teams Terrorize the IED Terrorists." *Defense Helicopter*. Volume 27. Number 1. Burnham, UK: Shephard Press Limited, January/February, 2008, 8-13.
- Howard, Michael. "Military Science in the Age of Peace." *RUSI Journal*, Edition 119 (March 1974), 3-11.
- Johnston, Paul. "The Question of British Influence on U.S. Tactical Air Power in World War II." *Air Power History*. Vol. 52 (Spring 2005), 16-33.
- McGregor, Caroline. "Eyewitness to History: Caroline McGregor talks to former Soviet Ambassador Yury Dubinin about his role in bringing an end to the Cold War." Edited by David Johnson. *CDI Russian Weekly*. April 30-May 13, 2004. Online at <<http://www.cdi.org/russia/304-4.cfm>> (accessed April 28, 2008).
- McLeary, Paul. "Rand Corp. study finds technology is more effective than force size." *Defense Technology International*. Aviation Week. December, 2007. Copyright 2008, The McGraw-Hill Companies, Inc.
- Rooker, Robert W. "Historical Recounting of Marne Thunder in OIF." *FA Journal*. Sept-Oct, 2003. Online at <http://findarticles.com/p/articles/mi_m0IAU/is_5_8/ai_110732256/pg_3>. Copyright 2008, CNET Networks, Inc. (accessed April 20, 2008).
- ROVER III Terminal. "ROVER Sics TacAir on America's Enemies." *Defense Industry Daily*. Posted September 10, 2007. Online at <<http://www.defenseindustrydaily.com/rover-sics-tacair-on-americas-enemies-updated-01700/>>, Copyright 2004-2008 Defense Industry Daily, LLC in association with Watershed Publishing, LLC. (accessed April 12, 2008).
- "Secretary: Army must be structured to deal with 'persistent conflict'." *Association of the United States Army – AUSA News*. January, 2008 Issue. J&S Publications, Inc.
- Simpson, Ross. "The Fall of Fallujah." *Tactical Weapons Magazine*. Volume 2. Issue 4. March, 2008. New York, NY: Harris Publications Inc., 73-81.

Government Documents

- Army Capabilities Integration Center (ARCIC). "Delivering Future Combat Systems Brigade Combat Teams" digital brochure. 22 February 2008. Online at <https://www.fcs.army.mil/downloads/pdf/FCS_BCT_Outcomes.pdf> (accessed April 29, 2008).
- Albright, John. "Convoy Ambush on Highway 1." *Seven Firefights in Vietnam*. Office of the Chief of Military History, U.S. Army. Washington, DC: Government Printing Office. 2005, 41-58.
- Feickert, Andrew. "The Army's Future Combat System (FCS): Background and Issues for Congress." *Congressional Research Service (CRS) Report for Congress*. Online at <http://www.ndu.edu/library/docs/crs/crs_rl32888_28apr05.pdf>, April 28, 2005 (accessed April 30, 2008).
- Francis, Paul L. "Defense Acquisitions: Future Combat Systems Risks Underscore the Importance of Oversight." Statement of Paul L. Francis, Director Acquisition and Resourcing Management (March, 2007). Excerpt printed in U.S. Army Command and General Staff College F104 Book of Readings, F104AD-3 to F104AD-18. Fort Leavenworth, KS: USACGSC, July 2007.
- Joint Chiefs of Staff. "Admiral Mike Mullen: Address to Command and General Staff College Students, Fort Leavenworth, Kansas, October 23, 2007." Online at <http://www.jcs.mil/chairman/speeches/071023Address_QA_CGSC.html> (accessed April 2, 2008).
- Program Manager, FCS Brigade Combat Team (2007). "FCS White Paper." Online at <<http://www.army.mil/fcs/whitepaper/FCSwhitepaper07.pdf>> (accessed November 1, 2007), 4.
- Romjue, John L. "The Evolution of the Airland Battle Concept." Air & Space Power Home Page. *Air University Review*, May-June 1984. Online at <<http://www.airpower.maxwell.af.mil/airchronicles/aureview/1984/may-jun/romjue.html>> (accessed April 25, 2008).
- U.S., Army War College. Department Of Military Strategy, Planning And Operations. *Campaign Planning Primer AY 07*. Carlisle Barracks, PA. 2007.
- U.S., Department of the Army. *Field Service Regulations, United States Army (Operations)*. Washington, D.C.: Government Printing Office. 1924.
- . FM 3-0, *Operations*. Washington, DC: Government Printing Office. June 2001.
- . FM 3-0, *Operations*. Washington, DC: Government Printing Office. February 2008.

- . FM 3-13. *Information Operations: Doctrine, Tactics, Techniques, and Procedures*. Washington, DC: Government Printing Office. November, 2003.
- . FM 3-90, *Tactics*. Washington, DC: Government Printing Office. July 2001.
- . FMI 5-0.1, *The Operations Process*. Washington, DC: Government Printing Office. March 2006.
- U.S., Department of Defense. JP 1-02, *Dictionary of Military and Associated Terms*. Washington, DC: Government Printing Office. April 2001 (Amended Through September 2007).
- . JP 3-09.3. *Joint Tactics, Techniques, and Procedures for Close Air Support (CAS)*. Washington, DC: Government Printing Office. September 2003.
- U.S. Government Accounting Office. “Defense Acquisitions: 2009 Is a Critical Juncture for the Army’s Future Combat System.” GAO-08-408 Defense Acquisitions. *GAO Report to Congressional Committees*. March, 2008.

Other Sources

- 11th ACR History. Online at <<http://groups.msn.com/11thArmoredCavalryRegiment/11thacrhistory.msnw>> (accessed April 14, 2008).
- “1981: Israel bombs Baghdad nuclear reactor.” *BBC On This Day: 7 June 1981*. Online at <http://news.bbc.co.uk/onthisday/hi/dates/stories/june/7/newsid_3014000/3014623.stm>, Copyright MMVIII (accessed April 29, 2008).
- A.Q. Khan’s Network. *GlobalSecurity.org*. Online at <<http://www.globalsecurity.org/wmd/world/dprk/khan-dprk.htm>>, Copyright 2000-2008 GlobalSecurity.org (accessed April 29, 2008).
- Airborne Operations in World War II. *GlobalSecurity.org*. Online at <<http://www.globalsecurity.org/military/ops/airborne1.htm>>, Copyright 2000-2008 (accessed April 12, 2008).
- Army Technology.com. “Capewell Wins US\$1.6M Precision Airdrop Award from the Australian Department of Defence.” Online at <<http://www.army-technology.com/contractors/logistics/capewell/press9.html>>, Copyright 2008 SPG Media Limited, a subsidiary of SPG Media Group PLC. January 8, 2008 (accessed April 25, 2008).
- Bell Model 209 "Huey Cobra". Online at <http://www.aviastar.org/helicopters_eng/bell_ah-1.php> (accessed April 12, 2008).

- BM-13 Katyusha Rocket. GlobalSecurity.org. Online at <<http://www.globalsecurity.org/military/world/russia/katyusha.htm>>, Copyright 2000-2008 (accessed April 10, 2008).
- BM-13 Launcher Specifications. GlobalSecurity.org. Online at <<http://www.globalsecurity.org/military/library/report/1987/MAF.htm>>, Copyright 2000-2008 (accessed April 10, 2008).
- C-119 Flying Boxcar. GlobalSecurity.org. Online at <<http://www.globalsecurity.org/military/systems/aircraft/c-119.htm>>, Copyright 2000-2008 (accessed April 11, 2008).
- "Entropy." Encyclopedia Britannica. 2008. Encyclopedia Britannica Online. Online at <<http://www.britannica.com/eb/article-9032727>> (accessed 10 January, 2007).
- Evans, Michael. "General Monash's Orchestra: Reaffirming Combined Arms Warfare." In *Land Warfare Studies Centre (LWSC) Working Papers No. 122, From Breitenfeld to Baghdad: Perspectives on Combined Arms Warfare* - pp 1-26. Edited by Michael Evans and Alan Ryan. Duntroon, AUS: Land Warfare Studies Centre, July, 2003.
- Fairburn, Sean B. "Closing on Baghdad." USAToday.com website. Online at <http://www.usatoday.com/news/world/iraq/2004-04-07-baghdad-closing_x.htm>. Copyright 2008 USA TODAY, a division of Gannett Co. Inc. (accessed April 26, 2008).
- Heavy Assault Bridge Basis of Issue Plan. Online at <<http://fas.org/man/dod-101/sys/land/docs/bnK056AA.htm>> (accessed April 26, 2008).
- History of the 101st Airborne Division. Online at <http://www.lzsally.com/sally2/archives/history_of_the_101st_airborne_di.htm> (accessed April 11, 2008).
- Hohnstine, Lyle D., LTC. "FSB Logistics Training at the CTC and Home Station." Global Security.org website. Online at <http://www.globalsecurity.org/military/library/report/call/call_95-11_ctcs2-4.htm> (accessed November 11, 2007).
- Holt, Robert J. "Rocket Tanks in the 752nd Tank Battalion." Online at <<http://www.752ndtank.com/RocketTanks.html>>, Copyright 2003 - 2007 Robert J. Holt (accessed April 10, 2008).
- Institute of Navigation. "Session E4: Time Keeping & Synchronization," Institute of Navigation website. Online at <<http://www.ion.org/meetings/past/gps2001/e4.html>>, Copyright 1995-2007, Institute of Navigation, Inc. (accessed November 10, 2007).

- Iran Demographics Profile 2007. *Index Mundi*. Online at <http://www.indexmundi.com/Iran/demographics_profile.html>, Information Source: CIA World Factbook (accessed April 29, 2008).
- Jaguar, Jet. "North Korea Transferred Nuclear Materials to Iran." *FreeRepublic.com*. Online at <<http://www.freerepublic.com/focus/f-news/1998304/posts>>, Copyright 2000-2008 John Robinson, FreeRepublic, LLC. (accessed April 29, 2008).
- Kerber, Ross. "US Forces Have Learned to Weather Sand." *The Boston Globe*. March 23, 2003. Online at <<http://www.globalsecurity.org/org/news/2003/030323-sand01.htm>>. Copyright 2003, Globe Newspaper Company (accessed April 12, 2008).
- Koukeas, George. "Reinstatement of the Cold War: The Russian Iran Alliance." *Canada Free Press*. January 22, 2008. Online at <<http://www.canadafreepress.com/index.php/article/1504>> (accessed April 29, 2008).
- Lanyon, Ken. "Getting In Synch – Part 1." *The Recording Website*, Copyright 2002-2003, Recording Institute of Detroit/Robert Dennis. Online at <<http://www.recordingwebsite.com/articles/sync1.php>> (accessed November 11, 2007).
- Medium A or Whippet (tank). *Encyclopædia Britannica Online*. Online at <<http://www.britannica.com/eb/topic-372738/Medium-A>>, Copyright 2007 Encyclopædia Britannica, Inc. (accessed March 5, 2008).
- Nebelwerfer. "Six-Barrel Rocket Weapon (The *Nebelwerfer 41*)," from the 1943 *Intelligence Bulletin*. Online at <<http://www.lonesentry.com/articles/nebelwerfer/index.html>>, Copyright 2003-2007, LoneSentry.com (accessed April 10, 2008).
- Rosenberger, John D., LTC. "The Burden Our Soldiers Bear: Observations of A Senior Trainer (O/C)." Global Security.org website. Online at <http://www.globalsecurity.org/military/library/report/call/call_95-11_ctc1-01.htm> (accessed November 10, 2007).
- Ryan, Alan. "Combined Arms Cooperation in the Assault: Historical and Contemporary Perspectives." In *Land Warfare Studies Centre (LWSC) Working Papers No. 122, From Breitenfeld to Baghdad: Perspectives on Combined Arms Warfare* - pp 53-63. Edited by Michael Evans and Alan Ryan. Duntroon, AUS: Land Warfare Studies Centre, July, 2003.
- Stubbs, Mary Lee and Stanley R. Connor. "Armor-Cavalry Part I: Regular Army and Army Reserve." *Army Lineage Series*. Online at <<http://www.history.army.mil/books/Lineage/arcav/arcav.htm>>, Washington, D.C.: Office Of The Chief Of Military History United States Army, 1969. (accessed April 14, 2008).

Supply Chain Glossary. "Synchronization." Planvisage website. Online at <<http://www.planvisage.com/resources-glossary.html>>, Copyright © 2007 Planvisage, (accessed November 10, 2007).

Synchronization Workflow Pattern (www.workflowpatterns.com). Online at <<http://is.tm.tue.nl/research/patterns/synchronization.htm>>, Website POC w.m.p.v.d.aalst@tue.nl (accessed 10 November, 2007).

System Theory Diagram. *The Systems Diagram*. Online at <<http://www.technologystudent.com/designpro/system1.htm>>, Copyright V. Ryan © 2001-06 (accessed November 20, 2007).

The Battle of Crete (World War 2). Explore Crete: The Travel Guide for the Real Crete. Online at <<http://www.explorecrete.com/preveli/battle-of-crete.html>>, Copyright 2008 (accessed April 12, 2008).

The Great War: The Complete History of World War I. Video documentary. Narrated by Patrick Boniface. Port Washington, NY: KOCH Entertainment LP, 2006.

U.S. Army. "Weapons Systems 2007-2008." Online at <<http://www.fas.org/man/dod-101/sys/land/wsh2007/62.pdf>> (accessed April 30, 2008).

Utility, Liaison, Observation Aircraft, Global Security.org website. Online at <<http://www.globalsecurity.org/military/systems/aircraft/utility.htm>> (accessed April 10, 2008).

WW1 Anti-Tank Rifles. Anti Tank Rifle Collecting and History. Online at <http://www.antitank.co.uk/ww1_anti-tank_rifles1.htm>, Copyright June 2007 (accessed March 5, 2008).

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